

**REPORT**  
**ON THE OUTBREAK OF**  
**BUBONIC PLAGUE IN BOMBAY,**  
**1896-97.**

By

**P. C. H. SNOW, Esq., I.C.S.,**  
MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY.

TOGETHER WITH

Reports from Mons. W. M. HAFKINE, C.I.E.; Brigade-Surgeon-Lieutenant-Colonel T. S. WEIR, Executive Health Officer, Bombay Municipality; and Khan Bahadur N. H. CHOKSY, L.M. & S., Extra Assistant Health Officer in charge of the Arthur Road Hospital.

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**Municipal Offices,**  
BOMBAY, *2nd October 1897.*

FROM

P. C. H. SNOW, Esq., I.C.S.,

MUNICIPAL COMMISSIONER

FOR THE CITY OF BOMBAY,

TO

THE SECRETARY TO GOVERNMENT,

GENERAL DEPARTMENT.

SIR,

In reply to Government Resolution No. 3045—2269-P., dated 2nd June 1897, General Department, I have the honour to forward the report of the Executive Health Officer and my own on the outbreak of bubonic plague in Bombay and the measures adopted for its eradication between the 23rd September 1896 and the 5th March 1897.

2. The origin of the outbreak is wrapped in obscurity, and all enquiries have resulted in failure to ascertain the actual date and appearance of the first cases. The task of accurately determining its cause is equally unsatisfactory, and there are no reliable data to show whether the plague was of indigenous growth or imported from the Himalayan villages, Hongkong, Turkish Arabia, or the littoral of the Persian Gulf.

It appears to be an acknowledged fact that fevers with glandular swellings have for years been known in Bombay, and several natives of respectability have informed me that they have seen in past years cases exactly similar, as far as they could judge, to the ordinary type of bubonic plague. If such were really the case, it is certain that the surrounding conditions were not favorable to the spread of the disease, and that the symptoms neither excited attention nor caused alarm.

In the year 1896, when the plague broke out, several native practitioners of the first standing acknowledged that from the end of the hot weather in May onwards they had come across several cases of peculiar fever which entirely puzzled them and usually ended fatally. It does not, however, appear that the bubonic swellings in such cases were apparent in a marked degree, and little further thought appears to have been given to the matter, which is no wonder considering the various obscure forms of plague noticed during the epidemic. These facts lend great probability to the theory that the plague was in some guise or another prevalent in Bombay for several months before its actual presence was ascertained and diagnosed.

Not a few competent authorities hold that the disease was brought here by pilgrims from certain villages in the Himalayan ranges where it is known to always exist. This theory is supported by the fact that in the months before the plague broke out there had been a stream of pilgrims, fakirs and devotees



from the north to the sacred shrines of Nasik, many of whom went to and fro between that place and the much-frequented temple of Walkeshwar at the extremity of Malabar Hill, and from thence wandered into the various portions of the City for the purpose of obtaining food and collecting alms.

Others hold that the plague was imported into Bombay from Hongkong either by the agency of human beings or rats. There is constant communication between the two ports, and this view is further strengthened apparently by the virulence of what was termed the first outbreak in Mandvi, a district full of grain and godowns, and in ordinary times infested by rats. Should any infected rats have got ashore from Hongkong shipping, and if brought to the docks it is fairly certain that they would, a rapid infection and stampede of thousands of rats would be sure to follow. On the other hand it must be remembered that there is no certain proof of the disease breaking out in Mandvi, although it came first into prominent notice in that quarter : the occurrence of the first cases are unknown, and the rise of the mortality in the commencement of September would tend to show that bubonic plague existed in a disguised or unrecognized form in several districts of the City simultaneously with Mandvi.

Further speculation on the above considerations is futile, but they present one grave cause of anxiety as to whether in a vast native City like Bombay the first cases of such an insidious and multiform disease will ever be readily recognized until the actual bubonic swellings have appeared.

3. The Health Officer in the course of his report has chronicled the climatic phenomena of the year, and his account is of historical interest to this, while it may be of scientific interest to future generations ; but whether the severity and brevity of the monsoon, the floods due to its concentration, or the scarcity caused by its early cessation, or whether the unusually high temperature of the latter half of 1896 had any influence upon the outbreak are questions upon which our present limited data render any conclusion difficult.

If, as there are reasonable grounds for holding, the plague was present in the City in some form or other during the months of May, June, July, and August 1896, I have little hesitation in concluding that the abrupt cessation of the monsoon on the 16th August and the extraordinary cloudy heat which ensued from September to the end of November constituted abnormal atmospheric conditions which assisted in its rapid spread and affected the general health of the whole City ; this adverse state of things was further enhanced by the great rise in prices, and the consequent indigence of the lower castes of people among whom the plague wrought such deadly havoc.

It must be remembered that the condition of Bombay has been distinctly progressive during the last 25 years, and all well-informed inhabitants admit that the general sanitary condition of the City has gradually improved. Indeed, all the Sanitary authorities who have lately visited the City have stated that it is the best kept and most sanitary oriental town they have seen. Unless, therefore, other adverse influences existed, or the plague was imported by chance, there are no ostensible reasons why it should have suddenly broken out in 1896 rather than in previous years. The great and ever present danger to the City arises from the floods of potable water—upwards of 30 millions of gallons—poured into it every day without sufficient means of escape : this, coupled with the obstruction of natural

channels of escape by the huge reclamation on the Tardeo Flats where the town sweepings are deposited, has caused a general rise in the sub-soil water which has attained a much higher level than it stood at ten years ago ; it is further probably much tainted in parts by contact with the sweepings on the flats. It is, therefore, highly probable that, although the sanitary condition of the City has improved in all outward appearances, the general conditions of health have deteriorated, thus rendering the inhabitants an easier prey to an epidemic of the violent nature now under discussion. The appearance of the plague in a famine year has further conduced to stimulate its vitality and onslaught on debilitated people in no condition to offer a normal resistance.

I am not, of course, ascribing the outbreak of plague to any such causes as these, but am merely indicating general conditions which may have increased its virulence. I will now proceed to discuss the general progress of the epidemic from the date of its first official recognition, the measures which were adopted against it, and the conditions under which those measures were taken with their results. Unless those conditions are clearly understood, it is impossible to gauge effectively the scope and results of the Municipal operations.

4. The first official intimation of the presence of plague in Bombay reached me on the 23rd September 1896. In August cases of fever with glandular swellings had been attended by Dr. Ranina and the two Drs. Underwood, and Dr. Ismail Jan Mohamed had treated two Multani pilgrims from Nasik ; other suspicious cases had been heard of by the Executive Health Officer, and a death was actually registered on the 31st of that month as due to bubonic fever. But, as already indicated, fever accompanied by glandular enlargements is not unknown in Bombay ; and it was long before bubonic fever was generally admitted to be bubonic plague. The difficulty of accurately diagnosing this multiform disease is admittedly very great ; many suspicious cases were put down as diphtheria ; the resemblance to enteric often made the differential diagnosis exceedingly difficult in the absence of bacteriological examination ; and even bacteriological examination not infrequently proved abortive in clear cases of the plague. The disease in its more infectious type was generally pneumonic and devoid of glandular enlargements, or was wont to take the form of high fever with slight cough. Doctors often differed in their opinions about cases, and no clearer illustration of the difficulties of diagnosis can be given than the fact that at the latest stages of the epidemic numbers of cases had to be segregated—and that by medical officers—not because the patients had plague, but because they had suspicious symptoms.

5. At the end of September the Health Officer, though still doubtful as to the character of the disease, was already on the alert. Extra carts and bigarries had been engaged, and men had been transferred from other sections for duty in Mandvi, Nowroji Hill, Chukla, and the Port Trust Estate. Early measures.

All cases of fever were treated as suspected ; houses and gullies were being vigorously flushed and disinfected, and all infected rooms limewashed.

All the flushing apparatus of the Health Department was in full employment, and the Fire Brigade had supplied three engines for the same service. All the bedding and clothing of the sick was burnt, and that of their neighbours, so far as possible, disinfected.

At the same time the Drainage Department were actively engaged in opening up, cleaning and flushing the drains and pouring disinfectants into them.

Between the 25th September and the 17th November the whole of the Port Trust drains, some 26,000 feet in length, west of the Frere Road as far as the G. L. P. Railway, were thoroughly cleaned of silt; as many as 1,337 men being employed on the work on one day. At the same time 450 openings were made and manholes constructed, and a large number of house gullies were remodelled and repaired. The manholes were carefully disinfected, and during this period the drains were thoroughly flushed with sea-water and carbolic acid which was poured into them by means of a centrifugal pump at the rate of 3 million gallons a day. The number of houses infected in this district was 180, and in all of them the house-connections were thoroughly overhauled. Where more than one case occurred, the down-take pipes were completely removed, washed in boiling water, and then dipped first into a strong solution of phenyle and afterwards into Dr. Angus Smith's solution at a temperature of 300° Fahrenheit before they were replaced.

Special flushing operations were at the same time being carried on in other sections and, as an experimental measure, road-watering was for a time carried on with a solution of phenyle. It is an interesting fact that of all the men engaged in these particular operations, though many suffered from diarrhœa and sickness, only one was attacked by plague.

Panic.

6. In order to appreciate the general lines and conception of the Municipal operations against the plague, it is first of all necessary to understand the exact position in which the responsible authorities were placed and the extraordinary difficulties under which they laboured.

Shortly after the commencement of October, and simultaneously with the more extended development of segregation and other measures, a wild, unreasoning panic appeared to seize the inhabitants, and continued with little intermission to the middle of February, when the crisis of the epidemic was past and the public began to re-assure themselves.

My office was besieged every day by natives of all classes imploring that nothing too drastic should be done, and every consideration should be shown to the people with a view of keeping them in the City and preventing an absolute stoppage of trade. The Health Officer has abundantly pourtrayed in his report the extreme terror which prevailed, and disquieting as that was from one point of view from another it was far more serious.

The sanitary work of the City of Bombay is carried on almost entirely by imported labour divided into two main classes—Halalkhores and Bigarries. The majority of the former pertain to the sweeper caste of Gujerat, nearly all the latter are Mahars from the Deccan. A very small percentage are true natives of Bombay.

These men numbering—Halalkhores 2,392, Bigarries 3,600—form the working basis of the sanitary system, and the slightest hitch in their organization, which is a most elaborate one, or depletion in their numbers, would immediately involve a

serious danger. Scattered as they are through every portion of the City in large numbers, any unrest or tendency to strike among them immediately effects other numerous low caste natives, and any development of panic or alarm straightway spreads to their immediate surroundings. Among the first to have followed their example would have been the large staffs of labourers employed under the Executive, Water and Drainage Engineers, on whom we were largely dependent for carrying on our struggle with the plague.

A strike of Halalkhores is not unknown in Bombay. The great Halalkhore strike occurred in 1866 and lasted for ten days ; 480 men left work causing an inconceivable amount of danger and nuisance. The scavenging Bigarries struck work on the 3rd July 1889 for a day and-a-half and again on the 29th of the same month till the 3rd of August. The whole City, except a portion of F and G Wards, was affected. Luckily the men on the Tardeo Reclamation did not join the strike, while the Halalkhores remained faithful and assisted in scavenging work. This strike, though so short and partial, was very serious and caused dangerous and widespread nuisances of every kind. It can be imagined, then, from the above data what would be the result if the whole body of Bigarries and Halalkhores struck work. In a fortnight the City would have to be abandoned, dependent as it is on the hand-removal of sewage and cart-removal of sweepings by these men.

It will thus be seen, in the face of a foe like the plague, with what grave anxiety the Municipal Executive regarded any possible spread of alarm or disaffection amongst its working staff. On their presence or absence, respectively, depended the safety or ruin of this vast and important City—a ruin which, in the midst of an increasing epidemic like the bubonic plague, would have been so absolute and complete as to render even partial recovery a question of years. On these men and their good-will hung the carrying out of every sanitary measure, and even in ordinary times were they all to remove from the town for a fortnight, Bombay would be converted into a vast dunghill of putrescent ordure. I grasped the hard reality of the situation in the end of September, and determined that, whatever else happened, the Bigarries and Halalkhores must be kept together at all hazards, as if they struck work and left, half the inhabitants would speedily follow them, and no single measure could be adopted against the plague either then or thereafter, nor could even the Europeans, Parsis, and high caste natives have remained in the City.

It must be remembered that in ordinary times these men are irreplaceable for the reason that even if drafts of sweepers were obtained from Rajputana and other places, they would be quite useless for several months until they had been thoroughly drilled and had become acquainted with the town : new men would have no knowledge of the various gullies and privies they had to clean, and would be quite ignorant of the difficult conditions under which they would have to work. With the plague raging in Bombay it would have been quite impossible to induce any sufficient number of sweepers or labourers from other places to come and work, in the face of the fact that the regular staff had gone and the inhabitants were moving hither and thither.

7. On the 6th October 1896, a notification granting extended powers to the Municipal Commissioner, under section 434 of the Municipal Act, was issued with

the approval of Government. Under this notification such measures of segregation and removal to hospital as had been adopted were legalised and continued, and the necessary right of entry into affected houses was placed on a clear footing.

The epidemic, however, continued to increase, and coupled with the operations in progress, was productive of widespread alarm. The people refused all medical aid or to listen to any advice, and many began to leave the City.

Discontent, unrest and alarm speedily manifested themselves among the Halal-khores and Bigarries; the Health Officer was in daily communication and held frequent conferences with me on this all-important subject, and every possible means was adopted to keep the men together. Throughout October the panic continued to increase, and with it the exodus from the City; resistance and obstruction were offered to every Municipal measure, whether of segregation, disinfection or cleansing, medical aid was rejected, and the attitude of the people was, "Let us alone to die, but do not interfere with our customs or prejudices which are far more important than any danger from the plague."

Of all the measures taken at this time for combating the plague, the one which caused most alarm was segregation or removal to hospital. The people not only regarded hospital treatment with detestation, but reports were freely circulated that the authorities merely took them there to make a speedy end of them. A gang of scoundrels took to blackmailing by personating the police and Municipal servants, and increased the general terror, extorting money, as they did, under threats of removal to hospital. Several of these free-lances were at last brought to book by the police, and with a few salutary convictions and sentences by the Magistrates that danger disappeared. None the less surely, however, the panic increased, and while our Municipal employes showed signs of wavering, the great body of mill-hands began to be infected by the general alarm and flight of so many persons from the City.

On the 10th of October, a number of mill-hands assembled outside the Arthur Road Hospital and threatened its speedy demolition as well as violence to the employes. After causing great alarm to the inmates and staff of the Hospital they dispersed. On the afternoon of the 29th October, a gang of nearly one thousand mill-hands attacked the Arthur Road Hospital with sticks and stones; they entered the compound, injured the tiles of the roof, struck some of the patients, and intimidated the staff. Luckily there was a telephone on the premises, and police aid was speedily summoned. The Commissioner, Deputy Commissioner, and a strong *posse* of European and native constables quickly arrived, the mill-hands were driven out, and order was restored. The incident was a very grave one, not so much in itself, but as an indication of general feeling, and the secret intelligence which I received from time to time showed that our sanitary staff were almost in open sympathy with the rioters owing to the fear of forcible segregation. This demonstration was exclusively directed against segregation of the sick and removal to hospital—the one measure which the whole people—high and low—viewed with the wildest hostility, and were determined not to tolerate.

8. On the night of the 30th October Mr. Vincent, the Commissioner of Police, with the Health Officer, met me at the Municipal Office to confer on the situation. We were all well acquainted with the main facts of the position and the

general feeling of the populace. The Commissioner of Police pointed out that the Baniahs in Mandvi and other parts had already begun to close their shops, others would assuredly follow, and looting and severe rioting were certain to ensue. Both he and the Health Officer were of opinion that our sanitary staff would make common cause with the rioters, nor was it possible to ascertain in a time of such wild panic and excitement how far the fine discipline of the Bombay Police force would avail to keep that body entirely under control. Our Halalkhores and Bigarries had for upwards of a fortnight been seeking every excuse to leave their work and get out of the City and had only been kept in hand by the ceaseless exertions of the Commissioner of Police with his Detective Staff, the Health Officer and his capable Assistant Mr. Leask.

Under these circumstances both the Commissioner of Police and myself were unanimous in considering that any kind of riot and disturbance at such a time meant the absolute ruin of the city and the cessation of all sanitary measures both then and thereafter. The bigarries, sweepers, cart-drivers and others would, with the first sign, have left *en masse*, and a vast panic and exodus of the general public would have ensued. Bombay would in a few days have become uninhabitable and left to reek in a mass of sewage, sweepings and pollution, with no one at hand to conduct the daily routine of sanitation, much less to adopt a single preventive measure against the plague. The pestilence in such surroundings would have increased a hundredfold and the remaining inhabitants would have been literally decimated and ultimately compelled to fly.

This was the situation which had to be faced on the 30th of October, and the crisis called for strong and immediate action. The obnoxious measure was compulsory removal to hospital and the safety of the entire City had to be placed in the balance against the possibility, and that a remote one, of a slight spread of plague from a modification of this measure. I had no hesitation as to the course I should pursue, nor in my opinion could an official responsible for the safety and welfare of the City in perhaps the gravest crisis which has ever beset it have adopted any other.

9. On the 30th of October I issued two proclamations explaining and modifying the segregation orders published under the previous notification of the 6th October. One of these was addressed to the general public, the other to that ever-present source of danger—the mill-hands. These proclamations were scattered all over the town in English, Marathi and Gujarati so as to reach all classes of the people. Their effect was soon visible, the general excitement and fear of riot calmed down and only the constant panic and alarm at the increasing epidemic remained as a disturbing factor. I have brought these facts prominently to notice, as without a knowledge of them the situation cannot be accurately gauged by those not behind the scenes, and further much misrepresentation, to say nothing of abuse, has been showered on the Municipal authorities for adopting a course which saved the City. This misrepresentation did not occur so much at the time; but months after, when the crisis of the epidemic had passed, public confidence had been restored, and a totally different state of feeling and circumstances existed, many critics arose asking why the Municipality had done this or had not done that, and more especially attacking my policy in this matter of segregation. The fact remains that had the situation not been dealt with at once and our measures

modified to suit the times, the City would have been in a week bereft of all its sanitary staff and the plague left to work its will unchecked and unopposed. I am in no way opposed to segregation where it can be safely carried out, but I shall show in a subsequent stage of this report that it never produced the results generally attributed to it when applied on a large scale, while up to the middle of February, when the crisis was past and the epidemic declining, any wholesale resort to such drastic measures would have certainly produced a deplorable catastrophe. The proclamations issued on the 30th October merely modified the previous orders and segregation was resorted to whenever and wherever practicable, both by isolation in houses and removal of cases to hospital. I would point out here that according to the published returns the number of attacks from bubonic plague was less in November, the month immediately succeeding the modification of the proclamation, than in October, the figures being—October 466 and November 339. I quote this as showing how little segregation had to do with the rise and fall of the epidemic.

10. His Excellency Lord Sandhurst throughout this trying time was fully aware of the difficulties under which the Municipal authorities laboured, and both by his sympathy and advice on many important points rendered the control of the operations a lighter task than would otherwise have been the case. The knowledge that the Head of the Government was from day to day taking the most active interest in all the operations against the plague in Bombay as well as stimulating and encouraging the efforts made by myself and the various heads of departments in the struggle with the epidemic materially contributed to the continuity and success of the measures adopted.

11. The epidemic increased rapidly in December, January and up to the 18th February, when the turn of the tide set in, the crisis was past and a steady progressive abatement took place with very minor interruptions. The alarm and horror at the plague and everything connected with it continued throughout those months and it was only by unremitting exertions that the sanitary staff were kept together. It was even necessary on one occasion to address the railway and steamer companies with a view to refusing the issue of tickets to Halalkhores and Biggaries trying to escape. Thanks, however, to the unceasing vigilance and tact of the Commissioner of Police and his Deputy, Mr. Gell, aided by the Health Officer and his Assistant, the danger was averted and the staff kept together.

Doctor Weir informed me in January after a careful study of the local progress of the disease that we were approaching the end of the crisis. He based his conclusions on the general tendency of the epidemic to move out of the central portions of the City and work north, west and south. In the middle of February he confidently assured me that the crisis was really over and an immediate decline in the total daily mortality and the bubonic epidemic might be expected. His prognostications proved absolutely correct, as from the 18th February a steady drop commenced; and I mention these facts as showing the remarkably accurate observation of the Health Officer and how closely he was in touch with every phase of the epidemic from its commencement to its end, both as regards its local distribution and general tendencies.

From the end of February native opinion became much re-assured and large numbers of people commenced to return to Bombay and continued to do so up

to the end of June, the only drawback being that, as it was a famine year many indigent and underfed people returned and subsequently undoubtedly conduced to an enhancement of the mortality. Those in want have throughout received money relief for which funds were most generously subscribed by various persons. Sufferers from the plague have also been regularly succoured.

On the 5th of March 1897 the Plague Committee was appointed and their operations came into force about the 1st of April. On the 18th of February the daily mortality returns showed a total of 282, including 130 attacks and 137 deaths from bubonic plague. On the 5th March the total daily mortality was 180, including 86 attacks and 82 deaths from bubonic plague. On the 1st April, from which date the Plague Committee's operations may be said to have really commenced, the total daily mortality was 126, including 67 attacks and 52 deaths from bubonic plague.

12. It would be futile to report on or discuss an epidemic of **Rats.** bubonic plague without considering the part played in its spread and the propagation of infection by the hundreds of thousands of rats which infest a city like Bombay. Their presence probably nullifies to an enormous extent the advantages to be derived from ordinary human remedies, while their absence, if such a state of things were ever found in cities and towns, would undoubtedly render plague operations far more effective.

From the time the bubonic plague had established itself in Mandvi at the end of September 1896, large numbers of rats were seen running about the streets and coming out of house connection pipes and drains in a sickly or dying condition. Many of them had buboes actually developed on the neck and groin. Bacteriological examination was carried out by the various specialists present in Bombay on numerous specimens and the plague bacillus was freely detected. It was thus clearly proved in Bombay from the outset, as has invariably been the case in other places, that the disease attacks human beings and rodents. Those acquainted with the life history and characteristics of the rat tribe are aware, if I may use the expression, of their extremely clannish habits. They appear to have regular means of communicating to each other any causes or symptoms of alarm, disease and danger. As an instance of this I may mention that when the well-known preparation "rough on rats" has been used with success in an infested house for a few days, the rats altogether disappear and will not be found to return for several months, sometimes longer.

In almost every quarter of the city where the bubonic plague appeared in force it was preceded by the presence of dying rats in considerable numbers. This condition was noticed both in the houses, open streets and gardens. In addition to this a regular migration of rats speedily manifested itself; its course was generally speaking from east to west and thence up the sides and centre of the island due north. Minor migrations also took place in the south of the city, and that on Malabar Hill was especially noticeable.

The bubonic plague travelled principally from east to west and then north, throwing out branches to the south and obtaining a footing on Malabar Hill later on. By the commencement of December nearly all the rats had disappeared from Mandvi and adjacent quarters of the city, while they were noticed in Kamathipura, Tardeo



and Byculla in great numbers, many of them being found dead. The bubonic plague followed in their track with unerring regularity. I was so struck with this portion of the plague phenomena that, in the end of December and January, I made a series of verbal inquiries from natives in various parts of the town. The replies were invariably the same, that the rats had disappeared from the centre of the city and were observed in great numbers on the west and north. In my opinion it is useless to seek further for the origin of the severe outbreaks in Worli village, Mahim and Bandra on the west, and Parel, Naigaon, Sion and Dharavi on the northern side. The enquiries I made showed that vast numbers of rats flying from the danger of the pestilence moved steadily in those directions and were noticed in numbers in places where they had not before caused remark. In this way not only would the local stock of rats have become infected, but the pestilence would be carried far and wide through the various houses. The great majority of the rats seem finally to have left the island, for in most of the infected localities only a few have been noticed up to the end of July where swarms existed before. The probability is that thousands of them crossed into Salsette and were in great measure the cause of the outbreak in so many Salsette villages of the Thana District.

The migration of the rats on Malabar Hill was of later occurrence, as the plague did not get a firm hold there till the commencement of 1897. Many rodents were observed dead or dying in the houses along the Walkeshwar, Pedder and Nepean Sea Roads and subsequently on the ridge of the hill, just before the disease broke out in force. By the middle of March not a rat was to be seen or heard on Malabar Hill and yet in ordinary times they infest the whole locality and are constantly appearing or making their presence known. They have never returned, or only such a few as to be unnoticeable. Since last March on the ridge where they were very plentiful, I have never seen a rat, and only a few of the musk tribe remain.

Precisely the same phenomena as regards rats have been noticed in Karachi during the recent epidemic. Dead rats were found in the vicinity of many infected houses as far back as December, and in one of the principal streets running through the main bazaar dead rats were picked up in hundreds during the first week of February, at which period and subsequently plague was raging in the vicinity. The march of the rats in Karachi was from west to east, and the outbreak and course of the plague in the various districts corresponded with and followed their migration.

The rats at Karachi finally proceeded in great numbers to the Civil Lines, where they were noticed in swarms such as had never before been seen there. The epidemic in these lines was of the slightest and practically confined to a few servants of European residents. The obvious conclusion is that the rats migrate on the first symptoms of danger, and dropping all their sick and diseased as they go along, keep ahead until they reach a place of comparative safety or have obtained freedom from the disease. The return of the rats has been noticed in several godowns in Karachi since June, and this, coupled with the fact that the plague has entirely disappeared, may be regarded as a sign that all danger is over at all events for the present. It will thus be observed that, as far as it is possible to compare a small city like Karachi with Bombay, precisely the same phenomena

have been observed in regard to the movements of rats and their connection with the propagation of bubonic plague.

The conditions detailed above are of the gravest import, and must largely influence the spread of the plague and the efficacy of any measures to be devised against it. It is indeed difficult to see how any measures of disinfection or segregation could fully avail until the migration of rats had ceased and the infected localities were free of this moving pest. While it is clear that until some effective means of destroying the rats *en masse* or preventing their migration is discovered the restriction of the spread of plague at its outset in any large city or town becomes an impossibility. It is extremely unlikely that any effective measures will ever be devised for dealing with this contingency, and while the migration which in Bombay lasted in the various districts for several months was going on, any advantages to be obtained from segregation and other measures were reduced to a minimum.

13. The measures adopted to meet the first outbreak of the pestilence in Mandvi have already been indicated, and it will be convenient here to give a general sketch of the sanitary steps taken. They varied somewhat under varying circumstances, and towards the end of the epidemic underwent certain modifications suggested by experience with a view to obtaining the most favourable results. The general treatment of houses embraced the thorough cleansing and disinfection of every room where a case occurred; all *moris, nahanis* and traps connected with the building were carefully disinfected. Dry chloride of lime or carbolic acid powder was sprinkled over the floors and passages, not only of the affected house, but also of the neighbouring ones. The building, inside and out, as well as the gullies, was thoroughly flushed, the roof opened, and all obstructions to light and air removed.

General sketch of measures adopted.

The house connections were overhauled as already described. All rubbish, such as rags, old clothes, etc., of which there were enormous quantities, and all infected articles of small worth, were burnt, anything of value being thoroughly disinfected, while the premises were lime-washed from end to end before re-occupation. The condition of the grain godowns on the Port Trust Estate attracted early attention, as it was found that numerous cases of plague were occurring in the dwelling-rooms above them. Interference with these warehouses was a matter which demanded very careful consideration, but the sanitary interests of the city were all-important, and in every instance where a case of plague was known to have occurred above a godown, the place was closed for 20 days, the grain and other merchandise were taken out and exposed to the sun in charge of ramosis, sulphur was freely burnt inside and outside the building, and the godowns themselves thoroughly flushed and disinfected.

Similarly in the case of shops, when a case occurred, no goods were allowed to be sold till they had been exposed to the sun for at least a day. The shops were not allowed to be used till they had been shut up and completely fumigated for 3 days, and even then had to be lime-washed before they were allowed to be reoccupied.

Two hundred and twenty-five godowns and 137 shops were treated in this drastic manner. At the same time large quantities of infected or damaged

sweetmeats and other food preparations were destroyed, and many tons of grain sweepings were found which had been collected from the streets and gullies for the purposes of adulterating sound grain. From one godown as much as 51 cart-loads of these sweepings were taken away and incinerated.

These measures met with the approval of the Sanitary Commissioner with the Government of Bombay as well as of other Sanitary authorities from all parts of India.

14. Operations were not confined to infected localities, but endeavours were made to anticipate the disease. In October systematic flushing and disinfection was carried out in the gullies, courtyards, and drains of the Fort and Market sections, and, whether on this account or not, it is a fact that those crowded localities passed through the crisis with a smaller mortality than others. Wherever the approach of plague was feared, disinfectants were distributed to the people with instructions how to use them—it was done, for instance, systematically throughout Kamatipura in December—but the results were hardly satisfactory, for most of the recipients persisted in scattering the powders in front of their verandahs, or anywhere, except in the damp dark places in their houses where they were really required.

Great attention was paid to the cleanliness of the sewers, and at the end of November those in parts of the Fort and Bhuleshwar were specially flushed and disinfected with perchloride of mercury and phenyle. Special sanitary precautions were enjoined upon the managers of mills, schools and other large concerns; while the graveyards were carefully watched with a view to the rigorous enforcement of the regulations.

In December the drainage and building branches carried out lime-washing operations on a large scale throughout a great portion of the city and suburbs in anticipation of the pestilence. The magnitude of the disinfecting and lime-washing operations carried out by the Municipality can be appreciated from the fact that during the months of December, January and February some fourteen thousand houses were treated by the Engineering Departments alone, while the Health Department were busily employed in the same work from the very beginning. Many houses were treated more than once, and every recurrence of plague was the signal for a fresh sanitary onslaught.

It has been shewn further on, how towards the end of the epidemic belief in the efficacy of ventilation to some extent superseded faith in disinfection, but the fact that in Kamatipura in some 404 houses where 511 cases occurred, only 89 were recorded after they had been lime-washed two or three times, goes far to show that whether it was the germicidal properties of the lime or the effect it had in brightening and lighting the houses, the measures taken in this direction were of great value in checking the disease. It cannot be claimed for them, more than for any others, that they were absolutely efficacious, for the plague appeared in epidemic form in districts where whole streets had been lime-washed from end to end in anticipation of its approach; but when the death-rate in Bombay during the pestilence is compared with the appalling mortality that has occurred at other times and places from the same

scourge, it is not unnatural to conclude that those measures to which the greatest energy was devoted in Bombay had something to do with the mitigation of the disaster. Besides the Engineering and Health Departments, the Fire Brigade gave the greatest assistance, and from the end of September till long after the constitution of the Plague Committee, they were hard at work flushing gullies and buildings. On the average three to five steamers were daily employed on this duty, each with its complement of eleven men, and in addition the Brigade manuals and pumps were freely made use of. Before quitting this topic, the Commissioner is desirous to place on record his obligations to Major Roughton and the Bombay Volunteer Artillery for the valuable services they rendered at Christmas time ; they came to our assistance at a period when it is hardly too much to say that every man's hand was against the Municipality owing to the widespread panic which the increase of the epidemic had engendered.

15. Towards the end of December experience began to indicate that dampness had a malevolent influence on the propagation of the disease.

No one who has devoted any time to the inspection of the dwellings of the lower classes in Bombay can have failed to notice the appalling indifference to waste of water. Not only do the majority of the people consider it necessary to turn a tap on full bore to clean their clothes, their bodies or even their legs and faces, but they habitually avoid the trouble of turning off the taps after they have finished their ablutions.

These things are easier to understand when it is borne in mind that there is an annual immigration of over a lakh of people from the districts, who are accustomed to draw water from a distance and with great labour. It is clear that when uneducated people of this type find taps ready to their hand, they will not make use of them in a proper manner.

The waste is of itself a serious matter, but it becomes doubly a matter for anxiety when the faulty construction of many of the chawls and houses is remembered. This danger had been fully realised in the past, but too much sentimental consideration had been given to the personal convenience of the people, with the result that all over the City taps were running full bore day and night often in places where no proper provision existed for carrying off waste water. The meter system has been persistently and repeatedly urged on the Corporation for acceptance, but all endeavours in that direction have failed. It is the one sovereign remedy for the existing state of things and the only objection ever seriously raised against it is that the Municipal underlings might use it as a means for extorting money, or that the meters are uncertain in their working. These considerations weigh little in comparison with the health of the whole populace of Bombay. At the end of December a campaign was instituted against dampness and house-connections were cut off wherever this danger was found to exist. Proceedings were very thorough in Kamatipura and water was at Christmas time cut off from the whole of the dwellings in that section. Subsequently the notification of the 10th February systematised operations in this direction, and it became part of the business of the health and medical officers to examine into the water-supply of houses during their daily inspections and some idea of the extent

to which the process was carried may be gathered from the fact that more than two hundred and fifty stand-pipes had to be erected in the streets to supply the wants of those deprived of water in their houses.

Of course replacing taps in a house by taps in a street could not prevent waste, indeed a casual observer might have thought the waste was greater. But while it brought the evil into greater prominence, the real advantages were enormous. Not only was the number of taps immensely reduced, but the water wasted, instead of deleteriously affecting the interiors of the houses, was freely exposed to light and air and rapidly carried away in the side gutters. Another measure adopted with the same object of keeping the city as dry as possible was the cessation of road watering of all except the principal thoroughfares. It was stopped on the 8th January and not resumed till the beginning of May.

16. Towards the end of the epidemic when it was raging with greater violence in the suburbs than in the city, experience had accumulated to show that dryness, air and light were the most essential requisites for successfully combating the disease; and while somewhat less attention was directed to disinfection and flushing, every effort was devoted to the removal of tiles and roofs from the buildings, the burning of all rubbish found in them, cutting off water connections and their temporary evacuation by the inmates. In support of this view it may be noted that the only way in which the comparative immunity of women of the unfortunate class on the one hand and the Municipal halalkhores on the other could be satisfactorily explained was by the fact that, though they are to be found in the most virulently infected neighbourhoods, they live under superior sanitary conditions in the matter of light and air.

17. The disinfectants chiefly used were perchloride of mercury, permanganate of potash, naphthaline, chloride of lime, carbolic acid, creosol preparations and quicklime: but others were also tried, and in disinfecting houses and their contents, the use of chlorine gas under pressure met with a considerable measure of success, more especially where the height and the narrowness of the stairs rendered the removal of furniture for disinfecting purposes difficult.

It was of the utmost importance that the lime used for washing should be of proper strength. This was no easy matter, but it is satisfactory to be able to say that from the beginning to the end the quality obtained was excellent. But to obtain the lime was not the only difficulty; the closest supervision had to be constantly exercised to see that its application was thorough: and it is to the credit of the superior staff that their efforts were so successful. The total amount spent by the Municipality up to the end of March on disinfectants and lime was over a lakh and a quarter.

18. The notification of the 10th February under the Epidemic Diseases Act has already been referred to in connection with water; but its principal provisions were to give the Municipal authorities greater control over buildings than existed under the ordinary law. It legalised not only the entry and disinfection of buildings, and the prevention of overcrowding, but gave the executive power as well to prohibit the use of insanitary houses or to demolish them, compensation for the value of the structure being assessed by Government nominees.

From the beginning of the epidemic it had been found that the only satisfactory method of dealing with the filthy temporary erections that existed in various parts of the city, and in which the plague made fearful ravages, was to summarily burn them down, and this had also been done in the case of a number of the servants' quarters in the more fashionable parts of the town. In addition a number of insanitary bungalows belonging to the military department in Mariue Lines and elsewhere were demolished in consultation with General Gatacre. But the notification in question greatly strengthened the hands of the executive and enabled them to extend these drastic measures to structures of a more permanent but equally insanitary character.

In a single street of Oomercarry 17 houses were condemned and demolished, and the total number so destroyed aggregated several hundreds. With the near approach of the rains and the return of many of those who had fled it became a question of great anxiety as to how the people thus rendered homeless would be sheltered if demolition was further carried out on a large scale, and it was eventually decided that while the inspection of houses should systematically proceed, they should be allowed to remain standing at any rate till after the monsoon.

In pursuance of this policy a special establishment was engaged, and up to date over 2,000 buildings have been carefully overhauled: while in the immediate future it is proposed to carry out these operations on an even more extended scale.

19. The great question of isolation of the sick has been dealt with separately, and it has been shown how the panic in October made it necessary to modify the stringency of our procedure. Modified isolation.

It must not, however, be supposed that all attempts at isolation were given up. The mere proposal of this measure resulted in the majority of the cases being concealed, but when they were detected arrangements were invariably made in the patients' own houses to give them the best chance of recovery possible by removing them to the lightest and best ventilated rooms, and every endeavour was made to dissuade all but the few necessary attendants from frequenting that part of the dwelling. At the same time where circumstances made it absolutely impossible to make any suitable arrangement, or where the patients were paupers or friendless, they were removed to the Municipal Hospital at Arthur Road. By degrees the panic subsided, the extraordinary rumours that the hospitals were torture-chambers and death-traps, that Government were collecting livers and all the foul brood of fantastic horrors died a natural death; and people began to realise that hospital treatment gave them their best chance of recovery. The numbers admitted during January and February steadily increased, and it was found necessary to open the Grant Road Hospital in addition to the enlargement of Arthur Road, and the opening of Parel on the 19th February.

20. Some of the strongest objections to the Municipal hospitals were based on caste. It would be a work neither possible nor suitable for a Municipal body to maintain separate infectious diseases hospitals for every subdivision of the population, and the question gave cause for much anxious consideration.

The solution of the difficulty—and it seems the only one—was found in encouraging the leading and more enlightened men of various communities to erect and maintain hospitals of their own.

As early as October private hospitals for Hindus on these lines were opened in Mandvi and Bhuleshwar, but this effort proved abortive, the unreasoning terror of hospital-life was still in full vigour and extended even to institutions managed entirely by men of their own class. Those from whom co-operation rather than obstruction might have been expected backed up the unreasoning voice of public opinion by the specious argument that hospitals, while unnecessary in themselves, were a source of the utmost danger to their vicinity. In December, however, more successful efforts were made in this direction. A Jain Hospital was erected in the compound of the Arthur Road institution, a little later Dr. Bahadurji opened a most successful and well managed Hospital for Parsis in Parel, and on the 28th January a Hindu Hospital, which did excellent service, was opened under the efficient management of the Hon'ble Dr. Bhaichandra Krishna. Similarly the Port Trustees opened a model hospital at Wari Bandar for their employés on the 23rd December, and through the energy of Professor Muller an institution was started at Modikhana for the servants of Europeans on 31st January. It may also be mentioned that a temporary hospital was erected in December by the Health Department at Narelwadi for the benefit of the people of that locality which was at the time being very severely visited.

21. The outbreak of bubonic plague being confined more or less to the central portions of the city up to the middle of January, the hospital accommodation was amply sufficient till towards the end of the month. With the spread of the plague to the northern portions of the island and the gradual subsidence of panic in the city, more extensive segregation could be enforced and the people themselves began to appreciate the benefits of hospital treatment.

At the end of January, finding the hospital accommodation insufficient, I entered into communication with the Sisters at Mazagon in order to obtain their services as nurses, and at the same time directed the Executive Engineer to put up nurses' quarters and enlarge the Arthur Road Hospital by adding another ward and extra quarters. The staff was also largely increased, the only difficulty being the scarcity of ward-boys. The Sisters were soon installed and the enlargement of the hospital relieved the pressure which a sudden rush of cases had produced. About this time the Executive Health Officer addressed me as to opening Grant Road Hospital and I had passed orders accordingly, but after conference with the authorities, who were on the point of opening Government House, Parel, as a plague hospital, it was resolved to set that institution going first and then open Grant Road. This was accordingly done and Parel Hospital was formally opened on the 19th February, General Gatacre having made the necessary arrangements in consultation with Government and the Municipality. Six Sisters from St. Joseph's Convent, Bandra, kindly volunteered to attend to the nursing. At the end of February, Grant Road Hospital was opened under Dr. Dallas and proved a very useful institution up to the final subsidence of the epidemic.

I have described in a previous portion of the report the panic which prevailed in Bombay and rendered attempts at segregation by removal to hospital dangerous and abortive. The result was that up to January the Arthur Road Hospital was only about half full; the accommodation was immediately extended and further nursing arrangements were made when patients began to come in numbers.

The Medical Officer in continuous charge of the hospital was Dr. Choksey, whose incomparable devotion to duty has already received substantial recognition at the hands of the Corporation. He has submitted an interesting report on the administration of the institution, which will be found in an appendix. Any further details here seem unnecessary, but the splendid work done is sufficiently attested by the fact that for the period from September to February, the percentage of mortality to cases admitted was 73·26, or 13 per cent. less than the ratio for the city as a whole, while in the month of February, when out of 3,332 reported cases only 91 recovered, 67 were cured out of the 365 who were treated in the Arthur Road Hospital.

22. Mons. W. M. Haffkine, who was deputed by the Government of India to enquire into the bacteriology of the disease, arrived in Bombay on the 7th October.

On the 10th January, after a series of careful and delicate experiments he successfully inoculated himself with a culture of the plague bacillus, observation of which had established that it would increase the resistance of man to the disease. A few enterprising gentlemen got themselves inoculated in the same month, and, by the end of February, over 1,200 persons of various classes had subjected themselves to the process.

The outbreak of plague in the House of Correction afforded a particularly good opportunity of watching the effect of M. Haffkine's prophylactic treatment. The interesting results obtained have been summarized in para. 511 of the Health Officer's Report. Centres of inoculation were established in various parts of the City, and H. H. Aga Khan kindly lent a bungalow for the purpose. A bungalow was also rented on Malabar Hill for laboratory work and to serve as a lymph dépôt.

Up to the 12th July, 7,380 persons of all classes had been inoculated in Bombay—exclusive of those dealt with at the House of Correction—and among them only 18 were attacked with plague, of whom two alone, both apparently under the influence of the disease when treated, eventually succumbed. From the 11th November M. Haffkine was engaged in endeavouring to prepare an antitoxic serum. His operations in this direction have been carried on at the Sevri Lazaretto, where Veterinary-Major Mills has given his cordial co-operation.

Up to the middle of August Rs. 21,600 had been advanced him for the purchase and keep of animals, &c., and M. Haffkine has succeeded in immunising a large number of horses.

A more general account of his work will be found in an Appendix to this Report.



Segregation  
of the  
healthy.

23. The importance of evacuating infected houses and localities was realised at an early date, and, when the disease appeared with concentrated virulence in a particular house, the whole of the residents were removed. Wholesale operations in this direction commended themselves to many men of light and leading, who could not reconcile themselves to the idea of compulsory isolation of the sick. On the 11th December an influential Committee was formed and approached me with the object of forwarding these views. A camp of refuge for the whole of Bombay was an utterly impossible scheme : but the proposal was obviously in the right direction, and I gave the Committee all the assistance and co-operation in my power.

Camps were opened for the healthy at Connaught Road and Northbrook Gardens, capable of accommodating 1,500 people as an experimental measure, but the difficulty of success in this direction was shown by the fact that these camps were hardly used.

Nevertheless the principle was successfully put into operation at various local centres of the epidemic, and in all the outlying villages,— such as Naigaum, Sewri, Koliwada, Warli, &c.,—it was the invariable practice to persuade or coerce the people to leave their houses for temporary sheds erected in the fields, and this measure was generally attended with the most satisfactory results.

Rao Saheb Ellapa Balaram at this time rendered great assistance to the cause of hut segregation by himself erecting and working at Foras road a temporary camp of sheds of considerable extent for several months.

The same course was followed by the Bombay Tramway Company, several clubs, hotels and mills, and many business firms in Bombay, and there are not a few instances where groups of families clubbed together and did the same. At the height of the epidemic and afterwards the whole of Northern Bombay where suitable sites could be obtained was studded with segregation huts ; to say nothing of the very large number of people encamped along the Maremma at Santa Cruz, Andheri, Goregaum and northwards : most of the refugees remained in camp till the middle of May when the disease had almost vanished.

Opposition  
to measures.

24. The bitter opposition to segregation has been described above and illustrated by the attack on the Arthur Road Hospital. That was the most serious exhibition of the general hatred of the measure, but it must not be supposed that this was the only instance of violence. Street tumults were frequent, crowds constantly collected round the ambulance-vans, which were stoned and damaged, while the officials of the Health Department were often in danger of their lives.

In the more general measures of sanitation, the difficulties of the situation were almost as great. All attempts to capture rats were fiercely opposed, and picking up a few sick pigeons almost produced a riot. The people would not believe that the hopeless condition of their own dark, damp, filthy, overcrowded houses was their real danger, they raved about the sewers and became phrenzied if a scavenger was remiss ; but, though experience over and over again illustrated, and Mr. Hankin's experiments proved the vital importance of cleanliness, light, and

free ventilation, every form of obstruction was resorted to when the Municipality attempted to deal with their dwellings. The tenants refused to do anything, maintaining it was the duty of the landlords. The landlords were not to be found, and when the Municipal employés were put on to do the necessary work, they had often to carry it out in the face of hostile, and sometimes violent crowds, and almost invariably in the teeth of sullen, if passive, opposition. Damage could not always be avoided, and it was natural that the loss resulting from interference with godowns and shops, and the inconvenience from wholesale disinfection should cause considerable discontent, but the Municipal files bear witness to the hopeless inability of the people to appreciate the value of sanitation, and throughout the epidemic the executive was subjected to a perfect storm of threats, abuse, and protests from individuals who deemed themselves aggrieved by the measures adopted to protect them. In the midst of this there were redeeming features. The Port Trustees throughout assisted the Municipality with the heartiest co-operation, a number of European and native gentlemen were ever ready to advise and assist, in every street row some were found to stand beside the executive and endeavour to calm the mob; after a time householders themselves helped in disinfecting and lime-washing their premises, and at a later stage the mill-hands proved of great assistance in turning the tiles and opening the roofs of their chawls, while towards the end, when the fury of the epidemic was most marked in the outlying villages to the north, the people themselves, as in the case of the Mazagon Kolis, occasionally adopted the measures suggested by the Health Officer.

25. By a careful examination of the issues of tickets on the various lines of *Emigration* traffic, it has been possible to form some idea of the extent to which the people fled from the plague.

The general process has been to compare the difference between the inward and outward traffic during the progress of the epidemic with that in the corresponding periods of the preceding year. Absolute accuracy cannot be claimed for such calculations, for there may have been many abnormal causes, besides the plague, affecting migration in the cold weather of 1896 as well as of 1895. Again, figures for the outward and inward traffic by road and by native boat are not available. Statistics were however collected during April and May, and the close approximation between the number of inward and outward passengers by road and native craft respectively, during those months seems to me a reasonable ground for assuming, that the exodus during the scare by these means bore but a small proportion to that by rail and steamer.

For most of the following figures I am indebted to the returns published by the Bombay Chamber of Commerce.

The exodus appears to have been—

In October 1896	...	...	...	about	20,000
„ November and December 1896	...	„	...	171,500	
„ January 1897	...	...	...	187,400	
„ February 1897	...	...	...	19,100	
			Total ... about		<u>398,000</u>

The outward flow began in October, and the smallness of its dimensions up to the end of that month may be ascribed to the fact that the disease was for a long time confined principally to one locality. The exodus increased through November and December, and reached its highest point in January, after which it rapidly subsided, and during March and April there was a steady stream back to Bombay. The appearance of plague in the various cities of refuge to which the people fled had probably great influence in checking the emigration from Bombay and the horrible mortality in some of those places must have gone far to persuade them of the advisability of returning to their ordinary avocations.

The population of Bombay at the census of 1891 was 821,764 and, taking into consideration the rate of increase between 1881 and 1891, we may assume that in 1896 the total number of persons in Bombay was about 846,000. Taking the exodus at roughly 4 lakhs, we shall not be far wrong in estimating that at the beginning of February it was reduced to something like  $4\frac{1}{2}$  lakhs.

The trade of Bombay has suffered severely during the period under description, but enquiry shows that famine conditions had as much influence as plague on its temporary decline.

Early in October Government, realising the danger of the plague being carried by railway to other parts of the presidency and empire, issued orders for the adoption of medical inspection of outward passengers at the Bombay stations, and by the end of the month some twenty Hospital Assistants were engaged on this duty at Bori Bunder and Byculla stations on the G. I. P. Railway, and at Grant Road and Bandora on the B. B. & C. I. Railway. It was decided that these arrangements should be under the direct control of Government, and this is not the place for any further account of them, but it may be noted that at the end of the epidemic in Bombay, when the plague had gained a hold on certain places up-country, the Medical staff at the stations was also utilised to protect Bombay against plague cases being brought into the city.

While the panic was at its height and the exodus in full flow, the scenes at the railway stations were striking—a motley crowd of natives of every caste and creed pressing and shouting for tickets, and then, as the train steamed in a hurrying anxious throng, old and young alike tottering under enormous bundles of household goods. As special after special left the stations, the relics of the disappointed crowd sooner than miss the next opportunity would quietly settle down to sleep on the platforms. The busy scenes at the station stood out in marked contrast to the quietness of Bombay; whole streets of shops were closed, business was paralysed and the desolate emptiness of thoroughfares ordinarily teeming with life was most remarkable and continued throughout the months of December and January, when the population had been reduced to its lowest figure.

Mortality. 26. The following table shows, for the year ending with July 1897, section by section and week by week, the number of recorded deaths from plague as well as the total mortality from all cases. In the third column is also shown the date of the first recorded attack in each section.

## STATEMENT showing the weekly number of

SECTIONS.	Popula- tion.	Date of the first reported attack of Bubonic Fever.	WEEK ENDING												
			4th August 1896.	11th August 1896.	18th August 1896.	25th August 1896.	1st September 1896.	8th September 1896.	15th September 1896.	22nd September 1896.	29th September 1896.				
			No. of deaths.		No. of deaths.		No. of deaths.		No. of deaths.		No. of deaths.				
			All causes.	Plague.	All causes.	Plague.	All causes.	Plague.	All causes.	Plague.	All causes.	Plague.			
Upper Colaba ...	4,335	1896. Nov. 28th ...	5	5	3	3	4	4	...	...	...	...	...	...	...
Middle & Lower Colaba...	13,623	Sept. 28th ...	3	7	8	7	7	3	3	5	8	...	...	...	...
Fort, South ...	3,951	Nov. 9th ...	...	1	...	1	...	...	1	...	...	...	...	...	...
Fort, North ...	32,847	Sept. 24th ...	19	23	15	23	22	20	20	17	14	...	...	...	...
Esplanade...	10,064	Oct. 24th ...	2	4	4	5	1	6	2	1	2	...	...	...	...
Mandvi ...	37,295	Aug. 21st ...	25	27	26	33	37	1 54	1 33	...	...	...	...	...	...
Chukla ...	32,197	Sept. 23rd ...	35	27	28	31	20	21	28	31	32	1	...	...	...
Umarkhadi ...	52,466	" 24th...	30	42	44	42	45	35	40	38	57	1	...	...	...
Dongri ...	30,317	" 23rd...	20	17	33	29	29	18	26	24	37	5	...	...	...
Market ...	44,751	" 27th...	15	24	20	26	31	20	30	15	23	1	...	...	...
Dhobi Talao ...	39,945	" 26th ..	30	24	36	36	36	29	28	26	27	1	...	...	...
Fannswadi ...	24,069	" 16th...	9	17	14	13	9	10	16	15	23	...	...	...	...
Bhuleshwar ...	33,363	" 25th...	18	17	17	20	25	30	40	30	23	...	...	...	...
Khara Talao ...	27,035	Oct. 4th ...	19	25	35	23	23	25	31	24	36	...	...	...	...
Kumbarwada ...	32,309	Sept. 26th ...	23	24	28	31	27	26	23	40	34	1	...	...	...
Khetwadi ...	28,814	" 23rd...	12	11	20	19	20	15	15	16	14	3	...	...	...
Girgaum ...	26,999	" 27th...	19	26	16	28	24	16	18	22	19	...	...	...	...
Chaopati ...	11,512	Nov. 28th ...	6	4	3	3	4	5	3	1	6	...	...	...	...
Walkeshwar ...	12,990	" 3rd ...	...	5	3	10	5	4	6	2	3	...	...	...	...
Mahalakshmi ...	17,014	Oct. 7th ...	8	4	3	3	1	8	2	3	3	...	...	...	...
Mazagon ...	33,640	Sept. 30th ...	20	24	16	17	21	15	23	26	31	...	...	...	...
Tarwadi ...	21,298	" 22nd...	7	14	21	24	18	16	13	10	12	1	...	...	...
2nd Nagpada ...	18,768	Oct. 1st. ...	23	19	17	17	24	12	19	19	24	...	...	...	...
Kamatipura ...	29,203	Sept. 26th ...	35	29	43	48	40	28	26	36	25	...	...	...	...
Tardeo ...	18,980	" 16th...	24	14	21	19	23	14	22	10	23	1	...	...	...
Byculla ...	47,403	" 22nd...	55	39	43	42	43	34	37	34	30	...	...	...	...
1st Nagpada ...	11,133	Oct. 2nd ...	3	4	4	5	5	7	6	12	6	...	...	...	...
Parcel ...	28,740	Sept. 27th ...	23	23	10	11	25	27	19	27	13	...	...	...	...
Bivri ...	6,063	Dec. 2nd ...	2	3	8	4	3	3	1	4	5	...	...	...	...
Sion...	19,601	Sept. 23rd ...	2	7	8	9	12	10	6	9	4	...	...	...	...
Mahim ...	18,505	Dec. 1st ...	14	14	21	14	13	7	10	13	16	...	...	...	...
Worli ...	25,493	Sept. 23rd ...	13	18	18	15	21	15	13	19	9	...	...	...	...
Water Division ...	22,142	Nov. 22nd ...	1	2	1	4	2	3	2	...	...	...	...	...	...
Non-Resident & Unknown.	.....	.....	7	20	19	22	11	23	14	16	21	...	...	...	...
Total ...	321,764		525	561	606	635	629	1 563	1 380	613	4 671	53	...	...	...

NOTE.—The figures in the



27. The following table shows month by month, for the period September 1896 to August 1897, the proportion of deaths to attacks :—

Months.					No. of Attacks.	No. of Deaths.	Percentage.
1896							
September	...	...	...	...	135	79	58.51
October	...	...	...	...	406	313	77.09
November	...	...	...	...	339	273	80.53
December	...	...	...	...	1,664	1,271	76.38
Total					2,544	1,936	76.10
1897							
January	...	...	...	...	2,537	2,108	83.09
February	...	...	...	...	3,332	3,241	97.26
March	...	...	...	...	2,661	2,443	91.79
April	...	...	...	...	1,420	1,268	89.29
May	...	...	...	...	418	363	82.14
June	...	...	...	...	186	93	50.00
July	...	...	...	...	62	43	69.35
August	...	...	...	...	124	71	57.25
Total					10,770	9,640	89.50
GRAND TOTAL					13,314	11,576	86.94

*Note.*—These figures do not embrace the final corrections to be made.

The extraordinary virulence of the disease from January to April is specially noticeable.

It will be seen that, on the whole, the ratio was 86.94 per cent. The table at page 112 of the Executive Health Officer's report shows that Europeans were almost immune, only one death from plague having occurred among them up to the end of 1896. Eurasians and Mussulmans enjoyed the greatest security after Europeans. Jains and Lingayets suffered most severely; other classes and races were more or less evenly afflicted.

The absolute immunity from plague throughout the epidemic of the Homeless Leper Asylum at Matunga with its 300 inmates may be considered one of the most remarkable features in the history of the present outbreak. Although the pestilence raged all round in the villages of Wadala and Matunga, and even in compounds within a hundred yards of the premises, not a single case has occurred among the inmates of the asylum even up to the present day. I think it would be an absurdity to conclude that leprosy affections produce immunity from plague, and I am of opinion that this singular preservation of the lepers arose from their inhabiting wide airy detached premises with free ventilation and sunlight throughout. This theory is in accordance with the views which experience shewed to be correct as to the efficacy of the various measures adopted to combat the plague.

28. As shown above (para. 25), the population at the beginning of the epidemic may be roughly estimated at 846,000.

The following table shows, as nearly as can be calculated, the monthly exodus, the total population remaining at the beginning of each month, and the probable number of deaths that occurred among them from normal causes :—

			Increase or decrease during previous months.	Population remaining.	Normal mortality at 36·00 per 1,000 per annum.	Actual number of deaths.	Difference between Cola.—4 & 5. Plague deaths.
1			2	3	4	5	6
1896							
August ...	...	...	...	846,000	2,538	2,838	300
September ...	...	...	...	846,000	2,538	2,775	237
October ...	...	...	...	846,000	2,538	2,994	456
November ...	...	...	−20,000	826,000	2,478	3,024	546
December ...	...	...	−71,500	754,500	2,263	6,243	3,980
1897							
January ...	...	...	−100,000	654,500	1,963	7,627	5,664
February ...	...	...	−187,400	467,100	1,401	6,928	5,527
March ...	...	...	−19,100	448,000	1,344	5,419	4,075
April ...	...	...	+24,500	472,500	1,417	3,618	2,201
May ...	...	...	+94,000	566,500	1,699	2,433	734
June ...	...	...	−11,000	555,500	1,666	2,326	660
July ...	...	...	not known	555,500	1,666	3,114	1,448
Total			...	...	...	...	25,828

The average death-rate in Bombay calculated on the basis of the figures of the last five years is 30·64 per 1,000, but the ordinary rate of mortality was probably greatly enhanced by the prevalence of famine with its attendant high prices and poor living.

In the famine years, 1876 and 1877, the death-rates in Bombay were respectively 32·25 and 52·00, and it will, therefore, not be unreasonable to assume a death-rate of 36·00 per 1,000 per annum as due to ordinary causes during the period under discussion. The figures in column 4 have accordingly been calculated on that basis. The next column shows the total mortality from all causes, month by month, and in the last is shown the difference between the two, which may be taken as the total mortality from plague.

It would be absurd to claim more than approximate accuracy for the above figures, but they roughly agree in the result with that obtained by Mr. James on somewhat more elaborate calculations, and as this report would hardly be complete without some attempt at gauging the total plague mortality, including concealed cases, the table has been inserted for what it is worth.

29. The trouble experienced by the executive in keeping together the permanent staff has already been referred to, and it can easily be understood how serious were the difficulties in the way of collecting and maintaining the additional staff required for the special measures undertaken to deal with the plague. Men who would serve as hearse-drivers were specially hard to find, and for a considerable period ward-boys were practically unprocureable at any wage. It is interest-

Establishment.

ing to record the total extra establishment eventually collected and the figures are given in the following table which shows the special staff actually working in the month of February 1897 :—

Departments.	Inspectors.	Sub-Inspectors.	Supervising Plumber.	Timekeepers.	Muckadams.	Labourers.	Paymaster.	Peons.	Extra Health Officer.	Special Medical Officers.	Assistant Surgeons.	Hospital Assistants.	Clerks.	Tile-turners.	Trip Markers.	Hearse Drivers.	Carpenters.	Cooks.	Ward-boys.	Ayas.	Sweepers.	Fitters.	Ambulance Men.	Engine Drivers.	Firemen.	Halakhores.	Mochees.	Surveyor.	Masons.	Painters.	Bhistas.	Blacksmiths.	Total.
The Health Officer ...	...	68	...	...	8	1,264	...	2	1	14	6	14	23	5	14	26	1	2	11	2	5	1	2	2	2	136	...	...	...	...	...	...	1,609
The Executive Engineer ...	2	...	...	...	1,000	23,457	...	...	...	...	...	...	...	...	...	1	1,182	...	...	...	...	...	...	...	...	...	1	11	6	21	3	25,684	
The Deputy Engineer—																																	
Water Works ...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Drainage ...	2	4	1	7	68	3,580	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3,662
The Chief Accountant ...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
The Chief Officer, Fire Brigade ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	3
Dr. Haffkine ...	...	...	...	...	...	...	...	3	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5
Total ...	4	72	1	7	1,076	28,301	1	7	1	15	6	14	24	5	14	27	1,183	2	11	2	5	1	2	2	2	136	3	1	11	6	21	3	30,966



STATEMENT of Special Expenses incurred by Different Departments of the Municipality in Connection with the Suppression of the Bubonic Plague.

	Expenditure passed and paid up to 31st March 1897.	Expenditure adjusted by Journal Entry in the Accounts for 31st March 1897.	Total up to 31st March 1897.	Paid in 1897-98.				Total payments in 1897-98.	Bills in Hand passed but not paid.	Total Expenditure against the grant of Rs. 54 lakhs sanctioned by the Corporation.
				From 1st April to 1st May 1897.	From 3rd to 29th May 1897.	From 31st May to 26th June 1897.	From 28th June to 31st July 1897.			
<i>Cost of measures adopted for the suppression of the plague.</i>	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Establishment including Office Clerks, Sub-Inspectors, Peons, &c.	6,639 12 8	.....	6,639 12 8	91 12 7	49 0 0	.....	42 15 0	183 11 7	.....	6,823 8 3
Medical Officers, Hospital Assistants, &c. ....	20,245 1 5	.....	20,245 1 5	676 5 7	115 3 3	.....	324 3 1	1,115 11 11	187 8 0	21,548 5 4
Police Ramosees ....	2,022 2 11	.....	2,022 2 11	89 9 8	97 10 6	.....	.....	187 4 2	.....	2,209 7 1
Labourers, Scavengers, &c. ....	24,028 14 4	2,083 3 11	26,112 1 3	2,825 15 9	176 10 4	.....	.....	3,002 10 1	.....	29,114 11 4
Mulakbars ....	4,208 6 5	.....	4,208 6 5	.....	62 8 0	.....	.....	62 8 0	.....	4,270 14 5
Tile turners ....	307 1 10	.....	307 1 10	.....	16 15 0	.....	.....	16 15 0	.....	324 0 10
Lime-washing, labour and stores (excluding lime) ....	35,789 2 10	20,340 8 4	56,129 11 2	.....	1,097 5 6	1,497 12 0	2,983 6 6	5,493 8 0	.....	61,623 3 2
Lime ....	36,784 1 9	.....	36,784 1 9	.....	18,881 6 4	11,245 9 1	3,479 7 5	33,606 6 10	.....	70,390 3 7
Medicines ....	5,340 3 0	.....	5,340 3 0	.....	303 8 0	2,562 14 0	240 9 0	3,106 15 0	.....	8,447 2 0
Disinfectants ....	31,598 9 2	61,783 13 9	93,382 6 11	2,286 9 10	500 0 0	344 12 0	.....	3,131 5 10	48 0 0	96,561 12 9
Stores ....	32,359 2 0	.....	32,359 2 0	205 0 0	5,180 1 6	8,078 14 10	36 0 0	13,500 0 4	.....	46,859 2 4
Putting up segregation sheds, hospitals, &c. ....	1,414 2 6	8,511 4 11	9,925 7 5	17 14 0	426 0 3	952 14 11	1,561 3 10	2,968 1 0	.....	12,883 8 5
Cleaning and flushing drains, gullies, &c. (including extra allowance to Fire Brigade Staff) ....	21,132 4 9	1,678 11 11	22,811 0 8	.....	536 10 0	686 5 0	.....	1,222 15 0	.....	27,033 15 8
Cutting off service-pipes and erecting stand pipes, &c. ....	1,292 4 0	11,851 13 5	13,144 1 5	.....	.....	.....	.....	.....	.....	13,144 1 5
Making ambulance carriages and purchase of vans and horses ....	875 0 0	.....	875 0 0	.....	455 0 0	367 0 0	.....	822 0 0	.....	1,697 0 0
Re-sowing silt, town-sweepings, &c. ....	19,889 7 11	.....	19,889 7 11	7,950 13 2	.....	.....	.....	7,950 13 2	.....	27,840 6 1
Printing, stationery, advertisements, telegrams, conveyance and other miscellaneous charges ....	7,030 0 0	6,746 1 4	13,776 1 4	1,705 15 9	859 6 4	909 6 5	432 0 4	3,906 12 10	154 0 0	17,836 14 2
Carrying out researches at the Sewri Lazaretto (including cost of office establishment, &c. under Dr. Haffkine) ....	400 9 10	10,990 7 11	11,391 1 9	.....	.....	.....	.....	.....	.....	11,391 1 9
Compensation for clothing, sheds, &c., destroyed ....	.....	.....	.....	.....	125 0 0	.....	130 0 0	255 0 0	.....	255 0 0
	2,54,856 7 4	1,23,986 0 6	3,78,843 7 10	15,850 0 4	28,882 5 0	26,555 8 3	9,234 13 2	80,522 10 9	389 8 0	4,59,254 10 7
<i>Outlay incurred on permanent works, &amp;c.</i>										
Purchase of four steam engines for gully-flushing ....	7,326 2 0	.....	7,326 2 0	.....	.....	5,910 0 0	.....	5,910 0 0	.....	13,236 2 0
Constructing manholes on Port Trust Estate ....	10,655 15 2	5,097 15 8	15,753 14 5	.....	.....	1,117 4 0	81 8 0	1,198 12 0	.....	16,953 10 5
	17,982 1 2	5,097 15 8	23,080 0 5	.....	.....	7,027 4 0	81 8 0	7,108 12 0	.....	30,188 12 5
<i>Recoverable from private parties.</i>										
Removing and repairing old fittings and replacing new ones ....	22,316 12 10	1,987 9 5	24,304 6 3	70 2 0	.....	.....	.....	70 2 0	.....	24,374 8 3
Cast-iron fittings ....	4,275 3 2	.....	4,275 3 2	.....	.....	.....	.....	.....	.....	4,275 3 2
Constructing catchpits ....	7,052 14 6	.....	7,052 14 5	.....	.....	.....	.....	.....	.....	7,052 14 5
	33,644 14 6	1,987 9 5	35,632 7 10	70 2 0	.....	.....	.....	70 2 0	.....	* 35,702 9 10
<b>TOTAL</b> ...	<b>3,05,983 6 11</b>	<b>1,81,671 9 2</b>	<b>4,87,055 0 1</b>	<b>15,920 2 4</b>	<b>28,882 5 0</b>	<b>33,582 13 3</b>	<b>9,316 5 2</b>	<b>87,701 8 9</b>	<b>389 8 0</b>	<b>5,25,146 0 10</b>

\* It has not been decided whether this should be wholly or partly recovered from the owners.

30. The following statement shows the special expenditure upon plague operations incurred by the Municipality up to the end of March 1897 :—

In addition to the above, up to 1st September 1897, Rs. 3,47,135-12-10 had been spent by the Municipality on behalf of the Plague Committee, and Rs. 4,84,500 had been placed directly at the disposal of the Committee for their own expenditure. The total amount voted by the Corporation for expenditure in connection with the plague aggregates Rs. 15½ lakhs, and of this Rs. 1,93,218-2-4 was still available at the beginning of September.

General conclusions.

31. The experience gained in the recent outbreak of bubonic plague in Bombay, added to that obtained in Karachi and Poona, goes to show that the course of the disease in its development and decadence is very similar to the Hong-kong epidemic.

In each of these cities, notwithstanding all the measures taken, the epidemic, subject to more or less marked depressions, advanced gradually to its culminating point in the course of about three months more or less. In Bombay the period was slightly longer, but when the great size of the city is considered, the discrepancy is not important.

Every kind of measure known to science was tried in Bombay at one time and another, and, as further experience was gained, the measures were modified from time to time. The brunt of the epidemic had to be encountered by the Municipal Executive, for the crisis was passed and the disease rapidly declining, when the Plague Committee was appointed, while a still more marked declension had taken place before their different plan of operations was in vogue. In this connection I would draw attention to the appended table which shows the percentage of decline from the 16th February 1897.

TABLE showing the decline in the Number of Deaths each Week from the 16th February.

Week ending	Total Number of Deaths including Still-born.	Percentage of Decrease.	Remarks.
1897.			
16th February	1,710	9.5	Decrease.
23rd "	1,634	4.4	"
2nd March	1,467	10.2	"
9th "	1,311	10.6	"
16th "	1,242	5.2	"
23rd "	1,115	10.2	"
30th "	1,120	0.4	Increase.
6th April	997	10.9	Decrease.
13th "	949	4.8	"
20th "	817	13.9	"
27th "	642	21.4	"
4th May	621	3.2	"
11th "	541	12.8	"
18th "	529	2.2	"
25th "	516	2.4	"

A perusal of the figures above set forth proves conclusively the success of the Municipal measures, and that the real danger was passed by the end of the third week in February. Not only was there a huge drop in the total mortality, but the number of plague cases had largely decreased by that date.

The Plague Committee, with the assistance of the military and undisturbed by any panic among the inhabitants, as this had completely subsided in March, proceeded to carry out general segregation of the sick and erected many more hospitals, both public and private, principally the latter, as regards the city proper. It will be seen from the table given above that under this system the percentage of decline in the plague continued much the same as under the municipal control, while the table given in para. 27 shows that the change of system made little difference in the percentage of mortality from plague cases until the fury of the epidemic was spent.

The recorded figures prove conclusively that the Municipal measures consisting in partial segregation and thorough disinfection and ventilation of buildings etc., had almost greater effect than the subsequent line of operations adopted, while it must be remembered that the Municipality were dealing with a rising epidemic, the Plague Committee with a falling one. Segregation of the sick, though undoubtedly a sound principle when applied to individuals, has in its practical application in an Indian city many drawbacks, and at no time in Bombay was it thoroughly carried out. As an instance of this, I may mention that of some 6,000 men employed as scavengers and halalkhores none were ever removed to hospital. Another point to be noticed about segregation in a city like Bombay is that it leads to immediate concealment and consequently to spread of the disease, while, by the fright it engenders, many persons may be rendered more susceptible to the ravages of the plague.

The public have now seen two different plans of operation against the plague in this city, and the success or otherwise of those operations can only be judged by the recorded results and statistics which are clearly set forth in the Health Officer's report. No impartial observer can, after studying the returns, come to any other conclusion than that the first set of measures was quite as successful as the second, while it is a noticeable fact,—and one remarked by all the leading scientists who came here,—that never in the course of history has a rising epidemic of plague in a vast city, such as Bombay, been kept within such moderate bounds. A lurid light has been thrown upon certain sanitary shortcomings of Bombay by the present epidemic. The principal of these may be found in the density of the population and overcrowding in chawls and houses. The second is the height of the subsoil water owing to the obstruction of natural escape channels and the lack of a complete storm-water system. The third is the introduction of upwards of 30 millions of gallons of water into the city every day from the Vehar, Tulsi and Tansa lakes without adequate means of carrying it off and the consequent waterlogging of whole localities and spread of dampness in many insanitary buildings. The fourth is the want of drainage, little more than a third of which has been completed for the total city area. Another urgent requirement is a more efficient system of birth and death registration.

As regards insanitary and overcrowded dwellings, the houses are being systematically examined with a view to the necessary measures being taken. A large scheme for the drainage of the Flats and reduction of the subsoil water and removal of storm-water is now under the consideration of the Corporation. The best means of obviating the scandalous waste of water and decreasing the amount

brought in would be the introduction of the meter system, but the Corporation has so far declined to sanction it. The drainage is being pushed on as rapidly as circumstances permit, and the adoption of the Shone system for that portion of the city which cannot be sewered by simple gravitation has been sanctioned by the Corporation. A scheme for establishing birth and death registration on a satisfactory basis is now before Government and the Municipality.

32. I find it necessary here to correct one or two statements in the Plague Committee's report which might otherwise lead to a misapprehension of the facts.

*Page 1.*—The excess mortality for the month of December 1896 is given as 4,559, while it was really 4,149.

As regards the remarks on registration, *page 2*, it must be pointed out that the defective system is owing to the state of the law, and, until that is amended and proper penalties enforced, no permanent improvement can be expected. The present system was strengthened as far as possible during the epidemic by the appointment of qualified medical officers and extra staff at the places of disposal for the dead.

*Page 3.*—The paragraph as regards the proclamation issued by the Municipal Commissioner conveys an entirely wrong impression. It must be remembered that the proclamation was issued after being submitted to Government, and with their full approval. The matter was also notified to the Corporation. No provision ever has been made in Infectious Diseases Hospitals in Bombay for the accommodation of different castes, nor was it ever made in the general hospitals of the Plague Committee. A limited number of relatives were always allowed to attend, and, subject to medical directions, make any arrangements they chose about food. No storm of protest whatever was raised by the proclamation itself, but, as pointed out in the chapters of the Health Officer's and this report dealing with the panic, every measure of segregation or otherwise before or after the proclamation was regarded with wild, unreasoning alarm. The modification was one of measures, legalised by the proclamation, which had commenced long before the proclamation was issued with the approval of the highest medical authorities.

*Page 4.*—The remarks as to Government House, Parel, are misleading and calculated to convey a wrong impression. Arrangements had been made and were on the point of being concluded for using Parel grounds as a large segregation camp. I had myself settled the different sites to be allotted with the Executive Engineer. Shortly afterwards, as a rush of patients to hospital had commenced and more accommodation was required, His Excellency the Governor informed me that he considered it preferable to start a hospital there, and that arrangements were being made to give effect to this proposal which was shortly afterwards carried out. It will thus be seen that, so far from making no use of the grounds, the Municipality were on the point of doing so when the hospital project was started.

*Page 14, last paragraph, "Municipal Vans."*—Before the Plague Committee commenced operations, the Health Department had nine vans and one ambulance with 16 horses, a number which amply sufficed up to the time wholesale

segregation was resorted to. Even after the operations of the Plague Committee had commenced, these vans were in constant use for all the long journeys, and the convalescent van was in regular use between Parel, Arthur Road, and other Hospitals.

*Page 15, "The Committee had resolved on the closing of the Grant Road Burial Ground."*—I may point out that this matter was not within the jurisdiction of the Plague Committee, the question being one for the Municipal Commissioner and Government. After the required certificates as to the state of the burial ground had been obtained and some very delicate and difficult negotiations carried out by the Municipal Commissioner with the co-operation of the Commissioner of Police, the matter was brought to a conclusion, and the order of Government closing the ground from the 30th April 1897 is embodied in Government Resolution No. 2112—1575-P, General Department, dated 21st April 1897.

*Page 153, para. 1.*—Under the orders of Government, the Health Department organized railway inspection with about twenty medical officers obtainable from Government at the time. Owing to famine pressure, more could not be spared and with the staff at our command the inspection was a work of great difficulty. The large staff which Government subsequently placed under Surgeon-Major Street for this purpose sufficiently emphasises the point.

*Page 181, last para.*—The steam flushing engine referred to is a Health Department engine, of which the Municipality has seven. They had been freely used with Fire Brigade manuals and engines throughout the epidemic.

33. It only remains for me now to express my warmest thanks and obligations to the energetic and devoted staff whose exertions contributed to the successful battle with the plague. The brunt of the operations in the Health Department fell on the Executive Health Officer, Brigade-Surgeon-Lieutenant-Colonel Weir, and his Assistant, Mr. J. Leask, and throughout this trying period these two officers continued to direct and supervise the operations with unflagging zeal, regardless of contumely, threats and personal danger. The history of the operations conducted and their results is a sufficiently eloquent testimony to the value of their services, and constitutes a record they may justly feel satisfied with.

Surgeon-Lieutenant-Colonel Kirtikar's and Surgeon-Captain Jennings' services were placed by Government at the disposal of the Municipality, the former from the 27th January and the latter from the 1st January 1897. Dr. Kirtikar did most valuable general work in house-to-house visitation and inspection with the special staff of hospital assistants placed at his disposal. His previous acquaintance with Bombay, where he had acted as Health Officer, and intimate knowledge of the houses and habits of the people, rendered his services specially efficacious.

Of Surgeon-Captain Jennings' services I cannot speak in too high terms. He was placed in charge of two of the largest and most populous wards, where he exercised the most efficient supervision and thoroughly carried out the disinfecting of houses and detection of cases. Besides this, he was specially employed from time to time in formulating the proposals for checking dampness by cutting off water-taps, the demolition of insanitary huts and buildings, lime-washing and many

other minor duties, all of which he performed with most conspicuous success and with untiring energy. I wish specially to bring this officer's valuable services to the notice of Government.

The Engineer's Department, consisting of Mr. M. C. Murzban, Executive Engineer, Mr. J. W. Smith, who acted in that capacity during the earlier portion of the epidemic, Mr. C. Carkeet James, Drainage Engineer, and the late Mr. Howard Newton, Water Engineer, rendered the most important service in putting through the various operations detailed in this report, and, in combination with the Health Department, largely contributed to their success. Throughout the epidemic they displayed the most untiring energy and resource, and, though the extraordinary pressure of work told on their health severely at times, they refused to leave their posts for a single day. Mr. James was especially conspicuous in pushing forward all the various operations in his special departments, which conduced to the eradication of the plague.

The Chief Officer of the Fire Brigade rendered incessant and useful service in gully-flushing and disinfecting with his manuals and engines, and the perfect discipline of his men enabled this work to be carried on with remarkable regularity and rapidity.

Mr. Douglas Bennett, Superintendent of Markets, had a most difficult task in keeping the market stall-holders together, but was successful in this direction throughout the epidemic which luckily affected the market-vendors in a very small degree. Mr. Saunders, Assistant Superintendent, Bandora Slaughter Houses, where a severe epidemic of plague took place, ably assisted in the conduct of this portion of plague operations.

All the heads of departments experienced a most trying time, and it must be remembered that, besides the vast work of coping with the plague, the heavy task of the city administration had to be carried on as usual.

From the Municipal Corporation of Bombay I received throughout the most loyal and consistent support; not only did many of its members take the keenest personal interest in all the measures adopted, but, as a body, they voted, with alacrity and cheerfulness, the large sums of money which had to be expended from time to time, and in every way facilitated the work of the executive. Collectively and individually, the Corporation stimulated and encouraged the exertions of its officers throughout the epidemic, and their cordial support materially reduced the difficulties of the situation.

I wish to specially mention the following members of the Municipal Body who rendered important services during the epidemic:—Sir George Cotton, President of Corporation; the Hon'ble Dr. Bhalehandra Krishna Bhatawadekar; Dr. K. N. Bahadurji; Dr. Ismail Jan Mahomed; Dr. A. G. Viegas; Dr. Katrak; Dr. D'Monte; Dr. Underwood; Rao Saheb Ellapa Balaram; Professor O. V. Muller; Veterinary-Major J. Mills; Mr. G. W. Roughton; Mr. R. H. Vincent; Mr. W. C. Hughes; Mr. T. W. Cuffe; Mr. Ibrahim Rahimtulla; and Mr. H. G. Gell. Whether in the erection and working of hospitals, co-operation in the work of combating the plague, or general assistance to the executive in carrying out the necessary

measures, their help was not only of the most important character, but directly contributed to the success of the operations.

Brigade-Surgeon-Lieutenant-Colonel Waters throughout the epidemic assisted the Municipality both by his advice and constant presence on the scene of operations. I cannot speak too highly of the value of the services of this officer, intimately acquainted as he was with the habits and customs of the people, and the most suitable system of measures to be adopted under such difficult circumstances.

I must here tender my cordial thanks and record my earnest appreciation of the splendid self-denying services rendered by the Mazagon and Bandra Sisters. Their ministrations to those afflicted by plague in Arthur Road and Parel hospitals, respectively, can never be forgotten and will remain as a lasting monument of their devotion to the cause of suffering humanity.

I come last, but not least, to the Police and the invaluable and cordial assistance rendered by Mr. R. H. Vincent, the Commissioner, and his Deputy, the present Acting Commissioner, Mr. Gell. It is not too much to say that, had they not stood by us from first to last and co-operated in every measure requiring their support, the effective administration of the Municipality during the epidemic would have been well nigh impossible. Government are well aware of the services rendered by these officers, and I need not dwell further on them here.

From the commencement of March I have had the energetic assistance and co-operation of the Deputy Commissioner, Mr. J. H. DuBoulay, I.C.S., who has both rendered me invaluable general assistance and also aided me in the preparation of the present report.

I have the honour to be,

Sir,

Your most obedient servant,

P. C. H. SNOW,

*Municipal Commissioner for the City of Bombay.*

## Extract from the Report on the inquiry into the Bacteriology of the Plague in Bombay, by Mon. W. M. Haffkine.

My investigations in Bombay began on the 8th October 1896. They were carried out originally in the Petit Laboratory, J. J. Hospital, and, from the beginning of April 1897, at the "Cliff," Malabar Hill, rented for the purpose by the Bombay Municipality.

Between the 8th October 1896 and 10th January 1897, these investigations were of a laboratory character, and had for their object the following main points:—the manner in which the plague microbe behaves in artificial media and the variation it is liable to undergo; the features by which it can be recognized in all its modifications, and amongst all other microbes which may come to associate themselves with, or to substitute themselves for, it in the Laboratory or in Nature; the effect of the microbe on animals, and the means of protecting them against it.

The data obtained in the course of these investigations will be made the subject of my report to Government. They enabled me to devise a plan of preventive inoculation against the plague analogous in its chief features to the method of combating small-pox by vaccination, and corresponding to Pasteur's methods of inoculation against anthrax and rabies, and to the method of inoculation against cholera.

In a letter dated 16th January 1897, addressed to the Government of India and to the Municipal Commissioner for the City of Bombay, the plan of these inoculations was briefly described, while particulars were afterwards given in the *British Medical Journal* of May and in the *Indian Medical Gazette* of June 1897. On the 10th of January last, I got myself inoculated with a dose of plague prophylactic four times larger than that applied afterwards to the general population. The operation was described in the above letter, and proved to be perfectly harmless.

A number of representative persons of the European and Indian communities were inoculated after that, and by the 30th of the same month the symptoms produced by inoculation had been studied upon 72 males and 5 females, with no ill effect resulting from them.

On the 30th of January an opportunity presented itself for testing the protective power of this method in the outbreak of plague in Her Majesty's House of Correction, Byculla.

The result of these operations was communicated to the Government of India and the Municipal Commissioner on 16th February 1897, and was as follows:—

On the morning of the day of inoculation, *before* the inoculations were done, there occurred in the jail 6 cases, of which 3 were fatal. The inoculations were performed in the afternoon. One of the inoculated had already a bubo before he was inoculated, 2 others developed buboes on the same evening. These three cases amongst the inoculated, which took place on the day of inoculation, also proved fatal. From the next morning a difference showed itself between the occurrences in the inoculated and the un-inoculated; and in the course of the next week, while the epidemic lasted, the un-inoculated, numbering an average daily strength of 172, produced 12 cases, of which 6 ended fatally, while the inoculated, of a daily strength of 148, had 2 cases and no deaths.

These observations tended to indicate that the inoculation arrested the disease in men at a very advanced stage of incubation.

The Laboratory experiments and the observations in the House of Correction formed the basis on which the subsequent operations were done. Their results corresponded fully with the observations made in the Jail.



In a letter dated 13th April 1897, I suggested to the Municipal Commissioner that the inoculations should be introduced in the affected districts of Bombay through the agency of the Municipal Medical Service. This could not be done up to now; and for a long time the inoculations were performed only amongst those who presented themselves at my Laboratory in the J. J. Hospital, and, from 27th March last, in the house which His Highness Aga Khan put at my disposal for that purpose in Love Lane. Afterwards 7 other centres were appointed by Government for carrying on the inoculations amongst persons who would present themselves there on their own account applying for inoculation. These centres were:—

St. George's Hospital.  
Cama Hospital.  
Gokuldas Tejpal Hospital.  
Colaba Lunatic Asylum.  
The House of Correction, Byculla.  
The Civil Jail, Umarchadi, and the  
Royal Marine Dockyard.

The following number of people were inoculated at these inoculation stations:—

(1) At the Petit Laboratory, Jamsetji Jijibhoy Hospital, or by the Medical Officers deputed from there	...	...	5,285
At H. H. Aga Khan's Bungalow, Love Lane	...	...	1,831
At the St. George's Hospital...	...	...	216
At the Gokuldas Tejpal Hospital	...	...	48
At the Cama Hospital	...	...	<i>Nil.</i>
At the House of Correction, Byculla...	...	...	<i>Nil.</i>
At the Civil Jail, Umarchadi...	...	...	<i>Nil.</i>
At the Royal Marine Dockyard	...	...	<i>Nil.</i>
At the Colaba Lunatic Asylum	...	...	<i>Nil.</i>

In order to further contribute to the spread of the inoculation, a number of Medical Officers were taught in my Laboratory the technique of these operations; these officers were:—

Bde.-Surgeon-Lt.-Colonel Arnott, Bombay.  
Bde.-Surgeon-Lt.-Colonel Barker, Bombay.  
Surgeon-Lt.-Colonel Boyd, Bombay.  
Surgeon-Major Bannerman, deputed by the Government of Madras.  
Surgeon-Major Dimmock, Bombay.  
Surgeon-Captain Childe, Bombay.  
Surgeon-Captain Herbert, Bombay.  
Surgeon-Captain Hojel, Bombay.  
Surgeon-Captain Street, Bombay.  
Surgeon-Captain Dawson, deputed by the Government of the North-Western Provinces.  
Surgeon-Captain Wilkinson, Punjab.  
Surgeon-Captain Dove, deputed by the Principal Medical Officer, Bombay Command.  
Dr. Miss Benson, Bombay.  
Assistant Surgeon Kantack, deputed by the Sanitary Commissioner, Bombay.  
Dr. H. Marques Fernando, deputed by the Government of Ceylon.  
Dr. M. Shrinivasa Rao, deputed by the Mysore Government.

Assistant Surgeon Gopinath Chintaman Chitnis, deputed by the Government of Baroda.  
 Dr. R. Unwalla, deputed from Bhowanagar State.  
 Mr. Nizamudin Pirally Bawa, recommended by the Political Agent of Kathiawar.  
 Dr. Ranade, recommended by the Diwan of Wadwan State.  
 Dr. Shroff, sent by the Health Officer, Bombay.  
 Dr. Murphy, sent by the Health Officer, Bombay.  
 Dr. deQuadros, sent by the Health Officer, Bombay, and appointed to carry on the inoculations in the Aga's Bungalow.  
 Dr. R. M. Kalapesi, Bombay, employed afterwards in the Plague Research Committee's Laboratory.  
 Dr. McCabe Dallas, Bombay.  
 Dr. K. S. Engineer, Bombay.  
 Dr. D. M. deSilva, Bombay.  
 Dr A. W. Dyer.  
 Dr. Patel, Bombay  
 Dr. S. B. Pocha, Uran.  
 Dr. V. S. Trilokekar, Bombay.  
 Dr. S. B. Naik, Bombay.  
 Dr. Sorabji Aderjee Doctor, from Naosari.

Of the above Officers the following performed inoculations in Bombay :—

Surgeon-Major Bannerman inoculated	...	...	...	...	120	persons.
Surgeon-Major Dimmock	„	...	...	...	46	„
Surgeon-Captain Childe	„	...	...	...	136	„
Dr. McCabe Dallas	„	..	...	...	209	„
Dr. K. S. Engineer	„	..	...	...	78	„
Dr. Murphy	„	...	...	...	202	„
Dr. Kalapesi	„	...	...	...	148	„
Dr. Trilokekar	„	...	...	...	26	„
Dr. Pocha	„	...	...	...	17	„
and Dr. Miss Benson	„	...	...	...	20 or 30	„

The total number of people inoculated in Bombay was 8,142, and was composed of—

Commissioned Government Officers and higher class of Europeans	...	96
Higher class of Merchants	...	256
Solicitors and Pleaders	...	37
Private Medical Practitioners, L.'s M. & S., and Assistant Surgeons	...	92
Veterinary Surgeons	...	4
Graduates of the University	...	63
Sisters of Mercy and Nurses	...	30
Police Officers (including Constables)	...	33
Clerks	...	662
Students and School Children	...	1,269
Artisans and middle class Merchants	...	438
Other middle class people	...	2,907
Lowest class of Tradesmen	...	120
Mechanics and Workmen	...	174
Servants and Coolies	...	1,825
Unclassified	...	136

There were, therefore, amongst them—

356 belonging to the highest classes of the population

5,535 " " middle " "  
2,119 " " lowest " "

and 136 unclassified.

Examined according to sexes and ages the numbers show—

Adult Males,	Adult Females,	Children of 10 and under 10,
5,259	1,668	1,079

and 136 unclassified.

According to races the inoculated persons represented—

3,414 Parsees,  
298 Brahmins,  
486 Kshatriyas,  
219 Vaisyas,  
805 Sudras,  
339 Other Caste Hindoos,  
1,478 Mahomedans,  
467 Europeans,  
414 Native Christians,  
84 Jews,  
2 Japanese, and  
136 Unclassified.

The plague incidences in the above number of inoculated were as follows :—

18 persons out of the 8,142 were reported to have been attacked, namely, 2, who were already unwell at the time of inoculation and who developed unmistakeable plague within 12 hours after inoculation; only these two died. The other 16 who were attacked, one, on the day of inoculation; one, one day after; one, 4 days; one, 5 days; one, 6 days; two, 12 days; one, a fortnight; three, 17 days; one, 27 days; two, one month; one, 5 weeks; and one, 3 months after inoculation, all recovered.\* In addition to that there was 1 death from hemiplegia which occurred in an inoculated person, apparently without any connection with the plague or with the inoculation.

The history of the attacked persons was watched in the hospitals and at their homes by the Medical Officers who reported their cases, and subsequently verified by an additional enquiry.

Thus the inoculations in Bombay appeared as the most powerful means of protection against the plague. This result was afterwards confirmed in every place where a number of inoculations was done, and where the epidemic was severe enough to make the effect apparent.

The following amount of prophylactic has been sent out to various places outside Bombay :—

*Amount of Plague Prophylactic despatched outside Bombay.*

Date.	To whom sent.	Doses or Number of Persons for whom Material sent.
January 25	The Engineer and Secretary, Karachi Municipality	100
February 9	Dr. Childe, for Matheran	30
" 10	The Civil Surgeon, Solapur	14
" 24	The Civil Surgeon, Surat	30
" 24	Do. do. do.	75
" 25	The Medical Officer in charge of Karachi Prison	80
March 8	Dr. S. M. Kaka, Health Officer, Karachi	100
" 12	Dr. S. F. Kapadia, Broach	200
" 14	Surgeon-Captain Lloyd Jones, Medical Officer on Plague Duty, Poona	50
" 14	The Civil Surgeon, Surat	63
	Carried forward	742

\* After this Report had been sent to press, a third death, apparently from plague, occurred in a person inoculated 8 months previously.

Date.		To whom sent.	Cases or Number of Persons for whom Material sent.
		Brought forward ...	742
March	14	... Dr. Cooper, Surat ...	100
"	14	... Dr. Rozario, Vice-Consul of Portugal, Bombay, for Damaon ...	171
"	14	... Dr. Kolapurwalla ...	49
"	15	... Surgeon-Captain Dawson, Lucknow... ..	140
"	20	... Surgeon-Lieutenant-Colonel W. M. McConaghy, Poona ...	300
"	24	... The Medical Officer in charge of Karachi Jail ...	330
"	24	... The Residency Surgeon, Bangalore ...	32
April	9	... By order of the Secretary of State, to the Medical Officer of the Local Government Board, London ...	1,000
"	15	... Dr. Rozario, Vice-Consul of Portugal, Bombay, for Damaon ...	100
"	19	... Dr. James A. Lawson, Plague Commissioner ...	150
"	25	... The Collector, Thana, for Tarapur ...	235
"	23	... Dr. C. P. Barry, Khandalla ...	240
"	28	... The Medical Officer, Bhuj ...	200
"	29	... The Municipal Health Officer, Karachi ...	200
"	30	... The Civil Surgeon, Hyderabad, Sind... ..	150
"	30	... The Medical Officer, Bhuj ...	150
May	1	... Dr. S. B. Naik ...	30
"	2	... Dr. Aderji, for Naosari ...	90
"	3	... The Municipal Secretary, Bulsar ...	150
"	3	... The Civil Surgeon, Hyderabad, Sind... ..	150
"	3	... The Superintendent, Punchghari ...	100
"	3	... The Municipal Health Officer, Karachi ...	210
"	4	... The Medical Officer in charge of Central Prison, Hyderabad, Sind... ..	125
"	4	... The Medical Officer, Karachi Prison ...	125
"	4	... Dr. S. F. Kapadia, Broach ...	30
"	4	... The Medical Officer of Bhuj... ..	125
"	5	... Dr. Suntook, Karachi ...	100
"	5	... The Civil Surgeon, Hyderabad, Sind... ..	150
"	5	... The Municipal Health Officer, Karachi ...	100
"	5	... Dr. M. E. Powri, Nacsari ...	60
"	6	... The Municipal Secretary, Bulsar ...	100
"	6	... The Medical Officer, Bhuj ...	180
"	6	... Mr. Akhunnvalli Mahomed Hasanali Sherwan, Sukhar, Sind ...	50
"	8	... The Superintendent, Matheran ...	90
"	8	... Dr. Nizamudin Pirally Bawa, Mahomedan Plague Hospital, Cutch Mandwi ...	200
"	8	... The Civil Surgeon, Broach ...	200
"	11	... Dr. Nizamudin Pirally Bawa, Mahomedan Plague Hospital, Cutch Mandwi ...	200
"	13	... Assistant Surgeon J. P. Pocha, Uran ...	100
"	21	... Surgeon-Major A. V. Anderson, Bassein ...	100
"	23	... Dr. Da Cunha, Damaon ...	190
"	31	... Surgeon-Major Nariman, Surat ...	100
June	2	... The Collector of Alibag... ..	170
"	23	... Dr. J. P. Parekh, Junagadh ...	200
August	1	... Dr. Da Cunha, Damaon ...	100
"	28	... Surgeon-Lt. K. V. Kukday, Karad ...	500
September	1	... 2nd-Class Hospital Assistant G. R. Salanke for Igatpuri ...	250
"	15	... E. Sale, Esq., Assistant Collector, Poona ...	755
		Total ...	9,317

Apart from that the following inoculations were done in mofussil stations either by myself, or by Officers sent out from my Laboratory :—

Damaun ... ..	in 1,737 persons.
Poona ... ..	in 2,007 "
Tarapur ... ..	in 500 "
Bulsar ... ..	in 457 "
Lanowli ... ..	in 508 "
Kirkee ... ..	in 1,302 "
Total ... ..	<u>6,601</u> "

The most important observations with regard to the effect of inoculation were collected in Uran, Damaun, Lanowli and Kirkee.

In Uran, Mora Municipality, Kolaba District, 419 persons were inoculated in the midst of a badly affected population. Only 4 of them got attacked with the plague, and rapidly recovered. They were attacked—one, a fortnight; one, 17 days; one, 27 days; and one, one month after inoculation.

In Lower Damaun 2,197 persons were inoculated between March and May last. On the 19th May, when the worst of the epidemic was over, an inquiry was instituted in Damaun by Professors Koch and Gaffky and myself, and afterwards, at my request, by Surgeon-Major Lyons, President of the Bubonic Plague Research Committee, with the object of investigating the effect of inoculation. Detailed particulars of this investigation, with the accurate data collected, will be published later on. They have shown that, while during the time under observation, 6,033 uninoculated inhabitants in Damaun had lost from plague 1,482 of their number, the 2,197 inoculated, who, when calculated upon the death-rate amongst the uninoculated, should have had 332 deaths, lost 36, which represents a reduction of mortality of 89·2 per cent.

At Lanowli, where the plague broke out in a severe form after the season visitors had dispersed and the population was reduced to below 2,000, the preventive inoculations, according to an agreement with the local Plague Committee, were concentrated in two parts, the most infected of the town. The observations were continued from the 22nd July up to the end of September 1897, and gave the following result :—

377 uninoculated inhabitants had 78 cases, with 57 deaths; the 323 inoculated, who lived with them in the same locality, had 14 cases with 7 deaths. Calculating upon the death-rate amongst the uninoculated, the inoculated should have had 49 deaths, instead of 7, which is a difference of 85·7 per cent.

At Kirkee the observations were concentrated amongst the followers of the four batteries of Artillery stationed there. Preventive inoculation was introduced one week after the commencement of the epidemic, namely, on the 14th of August last. From that date up to the 28th of September, when the last case occurred, the daily strength of the inoculated was 671 while 859 remained uninoculated. The latter lost from plague 98 of their number and the inoculated 17. Calculating upon the death-rate in the first group, the inoculated, who lived with them in the same huts and belonged to the same families, should have had 77 deaths, instead of the 17, thus showing a difference in mortality of 77·9 per cent.

These observations establish the preventive power of inoculation beyond any possible doubt.

As plague has reappeared in Bombay and is spreading in the mofussil, it is to be hoped that the preventive inoculations will now be given the widest application, as they represent the only measure known to Science up to now for combating that disease, and the effect of which has been established by accurate observations and measured in an unmistakable manner.

The theoretical acquisitions made during my present investigations cannot be recorded here, and will be embodied in my report to Government.

In addition to the work of preventive inoculation, and in accordance with the wish expressed by the Bombay Municipality, vast operations were undertaken and carried out by me in connection with the plan of obtaining an antitoxic serum for the treatment of plague similar to the treatment of diphtheria on the lines applied by Behring, Kitasato, and Roux. These operations were stimulated by the report of great success achieved in that direction by Dr. Yersin in China. My experiments have not yet been brought to a conclusion, and will be made the subject of a separate report. Their result has been negative.

BOMBAY, }  
The 1st of October 1897. }

W. M. HAFFKINE.

## Municipality of Bombay,

PUBLIC HEALTH DEPARTMENT,

BOMBAY, 27th September 1897.

FROM

BRIGADE-SURGN.-LIEUT.-COL. T. S. WEIR,  
*Executive Health Officer,*

TO

P. C. H. SNOW, Esq., I.C.S.,  
*Municipal Commissioner.*

weeks

prevail, have the honour to submit a report on the Epidemic of Bubonic Plague  
not break 1896-97 in Bombay.  
during of b

1. Before proceeding to describe and trace the appearance of Bubonic Plague in Bombay and the abnormal phenomena of the year, the growth and course of the epidemic, and the events that arose therefrom, it is well to examine briefly the incidence of the general mortality in the rainy season and during the last months of 1896.

2. From the table printed hereafter, showing the mortality according to place of birth, it will be observed that the number of deaths amongst persons born outside Bombay is as many as 5,945, in excess of the number born in Bombay. The mortality by place of birth, therefore, clearly indicates that there must have been during the year a great migration of people into Bombay.

*Table showing the Number of Deaths, exclusive of Still-born, according to Place of Birth.*

Months.	Bombay.	Elsewhere.	Unknown.	Total.
January ... ..	881	1,273	17	2,171
February ... ..	970	1,257	26	2,253
March ... ..	1,036	1,415	23	2,534
April ... ..	1,100	1,449	16	2,565
May ... ..	1,073	1,333	15	2,427
June ... ..	956	1,047	26	2,029
July ... ..	1,157	1,127	15	2,299
August ... ..	1,134	1,514	21	2,669
September ... ..	1,050	1,542	24	2,616
October ... ..	1,077	1,785	6	2,868
November ... ..	1,002	1,876	11	2,889
December... ..	2,141	3,958	32	6,131
Total ... ..	13,637	19,582	232	33,451

3. When the increase in the total mortality is studied closely, and examined especially in reference to the place of birth, it will be seen that the statistics demonstrate one of two things—either that the increase in the mortality in August was not due to bubonic plague, or that, if it was due to bubonic plague, the disease affected, out of the population, only the classes born outside of Bombay.

4. Any conclusions drawn from the total excess of mortality in August over the average mortality of the previous five years without a careful examination into the causes and incidence of the excess, and without due consideration being given to the causes of that excess, are likely to be either illusory or incorrect.

5. Moreover, when the mortality by months according to place of birth is examined, the surprising fact appears that, while the total mortality in August had increased by 370 over the number of deaths in July, the mortality amongst the people born in Bombay had decreased by 23, the increase, amounting to 387, being mortality being amongst persons born outside of Bombay. Still more surprising is the fact that in September the mortality amongst persons born in Bombay continued to fall and decreased by 84, while in October it increased by only 7; but in November it again decreased—the most surprising fact of all—by 71, while all these months from August to November, the mortality was steadily increasing amongst the people born outside the city. It would, therefore, appear that either the people born outside of Bombay had brought the disease to Bombay or were more susceptible to the pestilence than the people born in Bombay.

Months.	DEATHS.	
	Born in Bombay.	Born outside of Bombay.
July ... ..	1,157	1,127
August ... ..	1,134	1,514
September ... ..	1,050	1,542
October ... ..	1,077	1,785
November ... ..	1,002	1,876

6. These facts demonstrate that mortuary statistics cannot be treated as mere items in an account. I shall give another proof of the care necessary in drawing conclusions from mortuary statistics, although such demonstrations are familiar to every student of the subject. At the worst time during this epidemic, the mortality in one section (the Fort, South) never rose above 26·32 per 1,000. For the whole year 1896, the mortality in this same section (the Fort, South) was only 5·31, while in the city the general mortality was 40·70. If, therefore, mortuary statistics are to be received as ordinary items in a bill, the chances of life are seven times greater in the Fort, South, than in the rest of the city. This reduces absolute conclusions drawn from mortuary statistics without any reference to the conditions influencing the mortality to an absurdity. We are, therefore, forced to accept one of three conclusions in regard to the increase of the mortality in August if the enhancement in the number of deaths was due to Plague: (i) either that plague was prevalent in a number of places outside Bombay; (ii) or that it chiefly affected persons born outside of Bombay; (iii) or that there was an immigration into Bombay of people (a) either affected with bubonic plague, or (b) peculiarly susceptible to it.

7. The mortality by class is generally high, and, except amongst Europeans and Eurasians, higher than in the last year. Excluding the small communities liable to great fluctuations, the highest mortality has occurred amongst Jains and Hindu low-caste.

8. I have carried the diagrams exhibiting the mortality from Bubonic Plague on into 1897, as the progression of the epidemic in the year following often assists to an explanation of events in 1896 and not infrequently helps to a right understanding of the momentous period. Whenever events recorded in 1897 have helped to an understanding of the rise and progress of the epidemic in 1896, I have referred to these events and I have examined the statistics of 1896 in the light of information derived from the rise and decline of the mortality in 1897.

Diagrams.  
Bubonic Plague.

9. On the 27th of January we published, in addition to the number of registered plague deaths, the daily mortality from all causes. During the last weeks of January, considering the excitement of the people and the panic that prevailed, it was marvellous that the machinery for the registration of deaths did not break down, and the preparation of the mortuary returns cease. Nearly every house of business in the city was deserted by its clerks and peons.

Publication of  
Mortality.

10. The progress of events may be reviewed in the following order :—

The phenomena that preceded the epidemic.

Its progress.

Incidents in its progress.

Cases of fatality amongst animals.

Historical movements.

The public alarm.

Opposition to measures.

Measures.

Opening of hospitals.

Suggestions from the public.

Opinions of experts.

Preparation of serum.

Mortality.

11. We have had but a brief experience of the disease and it remains to be determined by observation elsewhere whether the phenomena observed here before and after the appearance of the disease, are the usual phenomena that precede or usher in, or accompany the malady. It will, therefore, be most interesting to observe whether these phenomena are repeated elsewhere or not. It will be well before proceeding further to record some of the phenomena that preceded the appearance of bubonic plague in Bombay, and, secondly, to describe some of the events and circumstances of importance during the progress of the epidemic.

Phenomena that  
preceded and accom-  
panied the Epidemic.

12. The mean annual temperature of the year was 80·7, the second highest on record in the last 51 years. The total fall of rain amounted to 87·6 inches, being 15 inches above the average. But the distribution of the rainfall was abnormal, for, instead of being distributed over four months, it was distributed over a much shorter period—a little over six weeks—and, instead of being succeeded

Rainfall.



by the great atmospheric disturbances designated elephants, the monsoon currents ceased in less than two months, and the thunder-storms which we look forward to as announcing the end of the rainy season were absent. The rainfall in June was 28 inches, or 8 inches above the average, and the rainfall in July amounted to 36.4 or 11.7 inches over the average. In August the rainfall amounted to 20.8 inches, giving an excess of  $7\frac{1}{2}$  inches over the average. The rainfall, therefore, was abnormal in its duration and in its distribution. It must be remembered that the sanitary effects of the annual rainfall on the public health are as marked as are the aberrations of the rainfall on agriculture. The heavy rainfall in 1896, as we remember, flooded with sewage the low-lying portions of the city, through which the polluted streams rushed in swirling currents, leaving banks of mud and sludge behind to ferment or slowly dry; and, moreover, the sewage flowed from the sewers on to the streets after each heavy downpour and rushed up the traps and flowed on to the low-lying ground. Unfortunately, in the beginning of the monsoon, a serious obstruction occurred on the Worli foreshore, in the outfall channel of the sewage. The stoppage took place during a great storm, and it was impossible to send men down in the heavy seas to remove the obstruction. Although the monsoon practically ceased in the middle of August, the shady sides of the streets in crowded portions of the city remained damp long afterwards. I find a note in the last week of August, drawing attention to it. In September only 1.6 inches of rain fell, being 10 inches lower than the average. This was the most abnormal month of an abnormal year yet recorded (even in the famine years of 1876-77, the September rainfall was not less than 4 inches); and an abnormal September was followed by an abnormal October, dry and warm.

13. The opinion of Mr. Baldwin Latham on the influence of the rainfall on public health is of great value. In a paper read before the Sanitary Institute, he writes: "The question of rainfall in India also greatly influences sanitary work. Rainfall may be an agent powerfully potent for good or for evil in India. In many parts of India, as in Bombay, the rain falls with a degree of certainty to which we are unaccustomed in this country. The great falls occur between May and October. In some parts of India, however, rain is distributed more or less at other periods of the year, but, as a rule, the wettest seasons are when the south-west monsoon is blowing. It is shown that in India, as a rule, the cities and towns are the healthiest in the years when they have the heaviest fall of rain, or in the year following a heavy fall of rain, while these same places are the most unhealthy in the year when there is a deficiency of rainfall, or in the year following a deficiency."

14. On the evening of the 2nd of October a little rain fell and lightning appeared in the east. The rain lasted for 20 minutes, and it seemed as if the cases of bubonic plague for some 12 hours diminished.

15. In July and August the humidity was higher than in the corresponding months of the last three years. This may be observed from the following table:—

*Table showing the Monthly Mean of Humidity.*

	1893.	1894	1895.	1896.
July .....	.84	.86	.85	.87
August .....	.84	.84	.85	.86

16. In December the humidity, notwithstanding the early and abnormal cessation of the monsoon and the higher temperature of the autumn, was higher than in 1895.

17. The temperature of the hot season was exceptionally high, and the temperature for the last four months of the year was higher than the average. The last months of the cold season of 1897 were exceptionally cool.

18. A gradual rise in the barometer in October, November and December was registered. The diminution of pressure indicates more soil air and more impurity of the atmosphere. The mean range in each month may be seen from the following table :—

	Barometer mean range.						
August ...	...	...	...	...	...	...	076
September	...	...	...	...	...	...	098
October ...	...	...	...	...	...	...	111
November	...	...	...	...	...	...	111
December	...	...	...	...	...	...	116
January	...	...	...	...	...	...	113
February	...	...	...	...	...	...	119
March ...	...	...	...	...	...	...	121
April ...	...	...	...	...	...	...	119
May ...	...	...	...	...	...	...	098

*The Maximum Temperature in Different Years Compared.*

Months.	1891.	1892.	1893.	1894.	1895.	1896.	1897.
January ...	87.1	88.1	85.0	84.3	81.6	85.1	89.0
February...	83.2	86.4	84.2	86.3	90.1	83.6	81.4
March ...	84.9	89.0	86.3	88.8	72.5	88.0	84.0
April ...	89.1	91.4	91.7	89.3	90.9	92.6	91.1
May ...	82.4	93.0	89.6	89.7	90.1	91.7	91.2
June ...	90.7	88.7	89.4	90.4	91.5	91.0	91.3
July ...	86.6	85.7	85.4	87.0	87.0	86.4	...
August ...	84.4	84.3	84.4	84.7	84.4	89.3	...
September	...	...	...	...	...	...	...
October ...	90.4	88.6	88.0	87.3	92.2	91.4	...
November	...	...	...	...	...	...	...
December	...	...	...	...	...	...	...

19. In 1894 about the time that bubonic plague came into Hongkong, phenomena affecting and corrupting the water-supply of Bombay appeared which ought to be recorded. I refer to a description in the Annual Report of 1894-95 of the phenomena :—

“ But in April the water in the Tulsi lake and also in Vehar was in a dangerous state of impurity from vegetable growths and vegetable matter. The water had an odour of decay. I attributed the unusual growth of vegetable matter to the abnormal atmospheric conditions and especially to the clouded sky, the effect of which was seen in the growth of vegetable matter in tanks within the city and wherever there was wet ground, and on the water of tanks between Bombay and Vehar.”

Floods.

20. In the early days of the monsoon of 1896, a writer thus described the floods to the north of the city :—

“The extraordinary flooding at the end of last week, especially on the vacant land in the north of the island, almost suggests that there must be some serious obstruction to the flowing away of the rain-water by the ordinary channels. This may possibly have been increased in these localities by building operations. Another possible explanation is that the ground is so saturated with water from an overabundant and wasted water-supply that it does not permit of the same percolation downwards that was possible a couple of years ago. Whatever the cause may be, all the vacant land north of Byculla between buildings looked on Saturday like pools of water, and where the water has subsided, banks of silt and sewage have been left, so that a stranger would think that some hill torrents had been flowing on to the low-lying parts of Bombay. We doubt if the health of the city will be improved by this. In some parts of the town, as, for instance, Bhendy Bazar, Parel Road, &c., there has been an unusual amount of water lying on the roads.”

21. The following descriptions of the inundations around Bombay taken from the *Times of India* of the 1st August are of great interest. They give a sombre picture of the floods around the Island, and we can contemplate the vast expanse of mud that lay putrefying as the waters subsided. I read : “The oldest inhabitant does not remember such unprecedented fall of rain as that which has deluged the country during the past few days.”

\* \* \* “These floods, which were not so heavy as those which followed, commenced to subside two days after when the weather showed signs of clearing, and it was generally hoped that the worst had passed, but the clouds began to gather again, the skies were overcast, and the rain came down in torrents, never ceasing till the evening of Thursday, the 30th. These latter rains helped to swell the floods to an alarming extent. The waters, continuing to rise, soon overtopped the Waldoni Bridge, and as the authorities entertained grave doubts about the safety, orders were issued cancelling all through trains. The rain holding off, the waters commenced to subside on Thursday morning, and large tracts of country were still submerged.”

Water-supply  
interrupted.

22. Owing to the great floods that swept across the Salsette plain the embankments of the Tansa line were washed away, the supply of water from Tansa was stopped, and consequently there was some difficulty in obtaining water quickly in Bombay. The result of this interruption in the water-supply was, as I find from a note at the time, that people commenced to use well water ; the effect of using well water was a considerable increase in the number of cases of diarrhoea. The water-supply from Tansa was cut off between the 29th of July and the 18th of August.

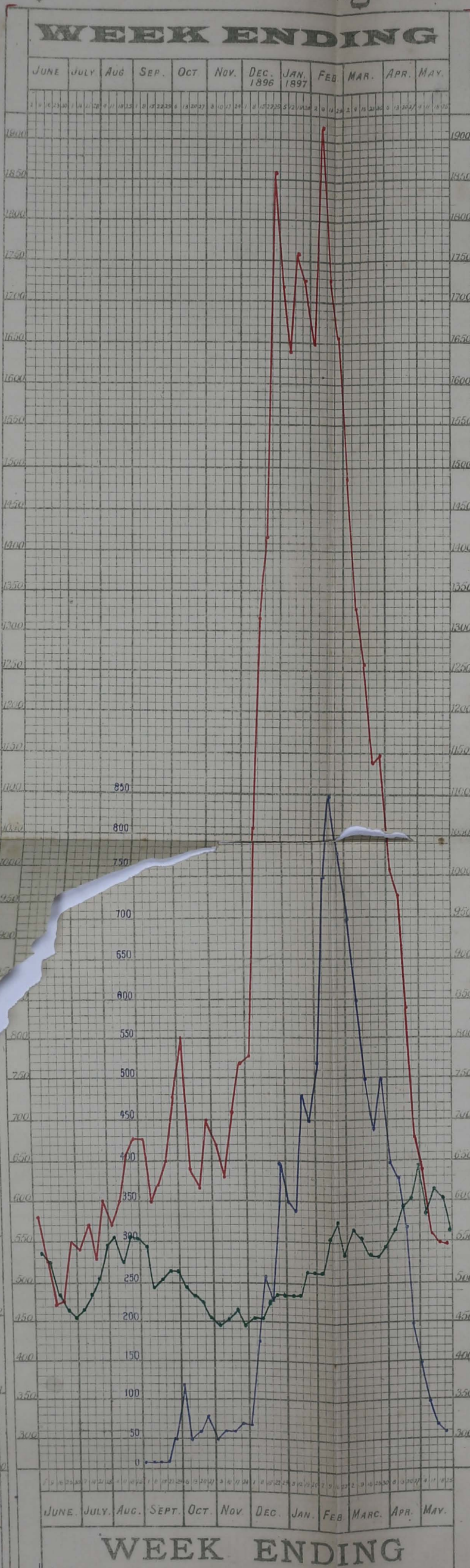
Re-distribution  
of Tansa water.

23. In the *Times of India* of the 21st August we read : “We are glad to find that it has been possible since yesterday to distribute again Tansa water. Since the damage to the embankment of the Tansa main and the stoppage of the supply on the 29th of July last, Tansa water has not been supplied, and it has not also been possible to give a filtered supply from either Vehar or

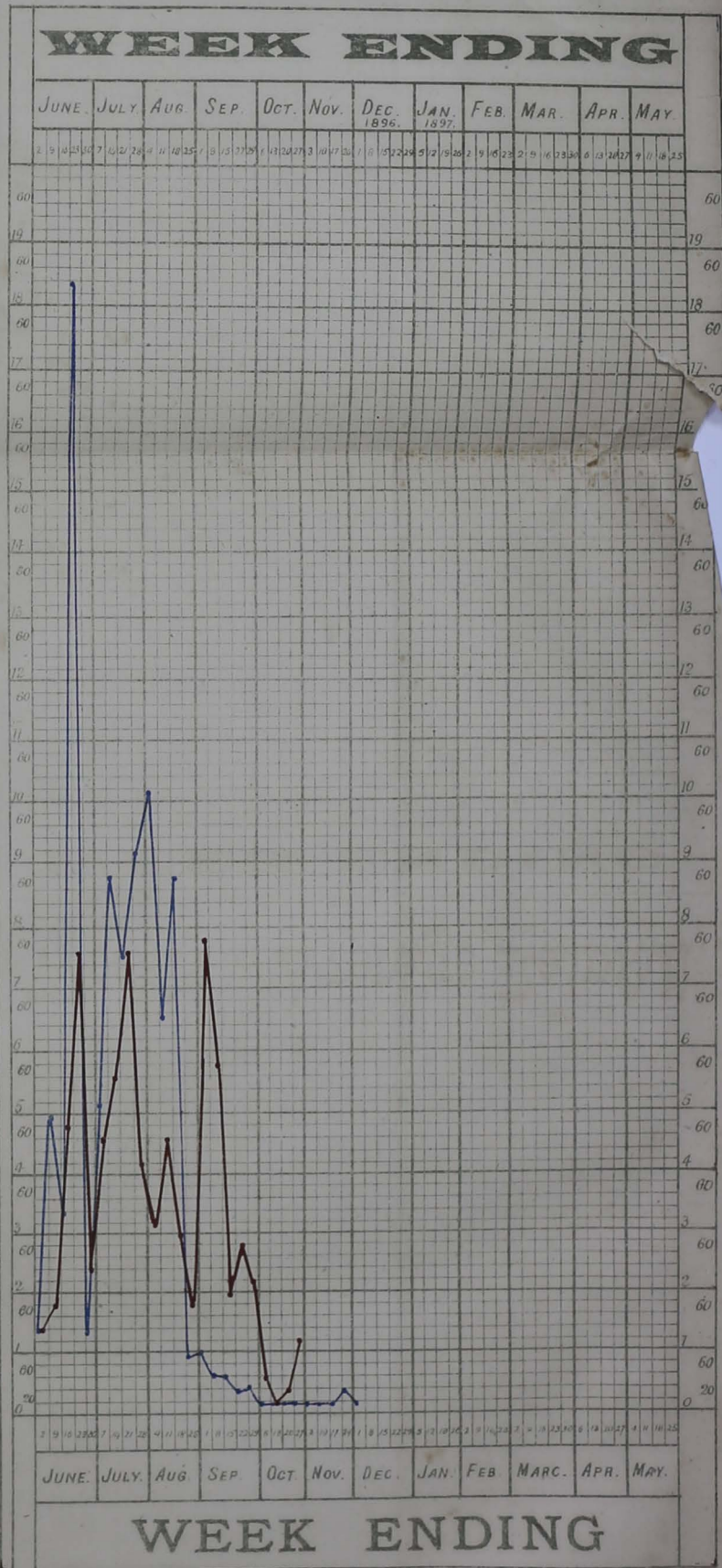


# DIAGRAM.

## Weekly Total and Average Mortality.



## Weekly AND Average Rainfall.



## Weekly Clouded Extent.



Weekly clouded extent ———

Weekly Total mortality ———  
 Weekly Average Do. ———  
 Plague mortality ———

Weekly Rainfall ———  
 Average Rainfall ———



even Tansa water. It is probable that there will be a considerable improvement in the public health during the next week, but we are not prepared to ascribe it to the re-introduction of Tansa water, however much purer Tansa water is than the supply from the other lakes, but rather to the break of the rains and sunshine acting on a saturated and sodden soil."

24. In September the godowns in Mandvi were still damp inside, and the woodwork in some of them mildewed.

We had therefore the following abnormal phenomena :—

1. An abnormal season of rainfall that lasted only about half the normal period ;
2. An abnormally high level of sewage after heavy rain in the arterial sewers of the city ;
3. Wet grain in dark and damp godowns or granaries underneath human dwellings ;
4. And further, a balance of some five million gallons of water a day left in the soil—the difference between the water coming into the city and the sewage going out—a balance indicating great danger at all times.

25. We have experienced the phenomena and suffered from the conditions Phenomena that preceded the epidemic. that precede epidemics of plague in endemic zones. All traffic to the Island was interrupted for five days or so. The grain lay in the wet. The low-lying portions of Bombay were under water. Swirling currents rushed down the streets and flowed by the buildings to the low-lying places under water. At the most distant points on the Esplanade, near the head of the drainage system, water welled up through the manholes. The subsoil water welled up where it had never been seen before. Wells overflowed that had never been full before.

26. Along the foot of Chinchpokli Hill I noticed that trees were killed by the drainage from the high ground above, and that they seemed to rot in the ground. We had therefore during this period wet grain, and wet granaries with no means of ventilation when the doors and windows were closed, and which were only opened to take out or put in grain. These are the conditions most favourable to the generation of disease, and had it been necessary to cultivate the microbe it would not have been possible to have created artificially more favourable conditions, *i.e.*, organic matter, moisture, warmth and darkness. These were the conditions that existed in granaries in the floors above which the disease first became epidemic.

27. Gibbon writes : " In a season of excessive rain the Tiber swelled above its banks and rushed with irresistible violence into the valleys of the Seven Hills. A pestilential disease arose from the stagnation of the deluge, and so rapid was the contagion that four score persons expired in an hour in the midst of a solemn procession." The phenomena that preceded the appearance of bubonic plague in Bombay were not dissimilar to the calamities that afflicted the capital of the world towards the end of the 6th century.

Letter to the Commissioner pointing out danger of immigration.

28. In August I wrote to the Commissioner pointing out the danger from the immigration of famine-stricken or destitute people into the city. In September prices were rising, and famine or scarcity coming. I have more than once drawn attention to the connection between the mortality in this city and the mortality in the country around, and I have pointed out that, as the deaths increase or decrease in the country, they increase and decrease in Bombay.

29. In the report for 1893 I wrote : "It has been observed in the sanitary history of this city, that whenever the season is abnormal, it is followed by a disturbance and unwholesome state of public health."

30. The statement hereafter printed, prepared by the Chamber of Commerce, exhibits exactly the pressure of scarcity after the monsoon on the poor in this city, and it will be observed from that statement that in the principal food stuffs prices had increased over 20 per cent. This table shows clearly that a year abnormal in its phenomena had been followed by a period of scarcity momentous to the population, for the relation between prices of food and fluctuations in the mortality have long been well recognized.

*Retail Prices of Food-grain in Bombay.*

Period.	Quantity sold per Rupee in seers and decimals of a seer of 80 tolas.						
	Wheat.	Rice (2nd sort).	Jowari.	Bajri.	Ragi.	Gram.	Toordal (2nd sort).
1896.	Seers.	Seers.	Seers.	Seers.	Seers.	Seers.	Seers.
August ... ..	13.62	10.72	15.94	13.94	15.75	12.19	10.19
September ... ..	11.03	10.05	14.10	13.59	12.37	10.62	10.19
October ... ..	7.81	8.44	10.44	8.62	13.50	8.12	8.31
November ... ..	7.12	7.81	8.56	8.28	13.50	7.81	7.97
December ... ..	7.12	8.44	9.78	9.62	11.53	8.75	8.62
Average for 5 months in 1896 ...	9.84	9.09	11.76	10.81	13.33	9.50	9.05
Do. for same period in 1895.	13.56	11.60	15.81	13.94	14.62	14.88	13.25
Annual average for 1895 ...	13.13	10.56	14.88	13.94	14.11	14.45	13.25
Do. for 1894 ...	10.95	9.63	13.50	14.02	13.45	14.69	13.25
Do. for 1893 ...	9.78	7.78	13.41	13.67	13.94	12.94	12.79
Do. for 1892 ...	8.43	10.05	13.78	12.68	14.44	12.79	8.69
Do. for 1891 ...	9.70	11.11	16.92	14.01	15.11	13.64	9.49

31. In July I was seriously alarmed by an outbreak of foot-and-mouth disease on this side of India and in the city ; it suddenly subsided in August. This sudden outbreak aroused my apprehensions of some epidemic appearing, and measures were taken to prepare for such a visitation. Special attention was given to the state of the sewers throughout the city and to conservancy measures. The drainage of the district of Mandvi, in which the disease first appeared in an epidemic form, had given cause for great anxiety for some time. In the beginning of September my attention was drawn to four deaths that had occurred on Maudvi Bunder. None of the cases had been attended by medical men, and death was preceded by enlargement of the glands around the neck, and from the descriptions given to me the cases seemed almost like diphtheria.

Four cases at Mandvi in September like diphtheria.

32. The first public notification of this disease was by Dr. Viegas in the end of September, and Dr. Viegas deserves much credit for the diagnosis of the case. I had no doubt even before as to the nature of the disease, and from the first the disease was treated as bubonic plague. But I hoped that as before when cases of fever with glandular enlargement occurred the disease would not spread, and I believe we would have been as successful as at other times had the rats not been infected and had the year not been abnormal and food scarce and dear. It is true that the microbe in the laboratory is not affected by atmospheric changes, but looking over the historical invasions of the disease, it is difficult to believe that it is not influenced by conditions that favour or control the development of all forms of life, and that it has not its seasons of growth and decay. However, we have seen that the predisposition to the disease is influenced by the state of bodily and mental health and that those who were depressed, either in mind or body, were most often attacked and most frequently succumbed. In passing a judgment on the difficulties of recognition in the first cases, it has to be remembered that fevers with glandular enlargements are not unknown in Bombay and that even now with the knowledge possessed of the disease in its varying forms, and notwithstanding the suspicion with which cases of fever are regarded, the recognition of some cases of bubonic plague is most difficult even in an hospital.

33. Public alarm was aroused after the expression of opinion by Dr. Viegas that the disease was true bubonic plague. I reported that the cases were engaging our most serious and constant attention.

34. An early case was seen by Dr. Ranina in August in Bhandup Street. The patient was unconscious when first seen; temperature 103. According to the history, given by friends of the patient, fever had suddenly come on without any premonitory symptoms. There was great pain in the left hip which led to the discovery of two large glands below Poupart's ligament. Drs. E. F. and C. F. Underwood had before this treated some suspicious cases with cedema over the glands of the neck. I had been consulted and seen four of the cases, and of two of these cases I have been shown a photograph.

35. The recognition of the disease was due to its prevalence in one portion of the city amongst a class who believed in medical men. Had the disease been of the more infectious type, the pneumonic without external glandular enlargements; had it been a rapid form of fever with slight cough—the type assumed by the plague during the epidemic period—there can be little doubt its recognition would have been very difficult. Dr. Viegas therefore displayed much acumen in the diagnosis of the first case.

36. Three deaths that occurred in Walkeshwar from fever and pneumonia in the week ending the 25th August 1896 attracted my attention. Two of the deaths were of mendicants and the third of a servant. In this week the mortality in Walkeshwar section rose to 40 per thousand from 12 per thousand in the preceding week, and it again fell in the following period. The fair in Nassick commenced on the 13th August, and large numbers of pilgrims from Upper India had passed through Walkeshwar on their way to Nassick.

Period when bubonic plague appeared, difficult to fix owing to increase in mortality being synchronous with increase of mortality outside Bombay.

37. There are reasons for thinking, if not believing, that the event of the pilgrimage to Nassick had an important influence on the propagation of the pestilence in this city. It has to be recollected, in forming an opinion as to the period when bubonic plague commenced in Bombay, that synchronously with the increase in the total mortality in this city, there was an increase of the mortality in a number of places close to Bombay.

Thana—increase in mortality.  
Poona.

38. For instance, in the Thana Collectorate, the mortality rose from 1,848 in July to 2,691 in August. In the Poona Collectorate the mortality rose from 4,384 in July to 5,286 in August.

Surat.

39. In Surat City the mortality rose to 2,024 in July, and decreased to 1,886 in August.

Kurrachee.

40. In Kurrachee the mortality, which had been 1,929 in January, decreased to 702 in August and rose to 906 in September.

The increase of mortality in this city synchronous with increase of mortality around.

41. In the presence of these facts it is difficult to ascribe the excess and the increase in the total mortality of this city in August to bubonic plague. The increase in the mortality of the city was synchronous with an increase in the mortality in a number of places around Bombay. If it is held that the increase in Bombay was due to concealed cases of bubonic plague, because no better explanation of the increase occurs, it may just as reasonably be held that the increase in the mortality in other places was due to the same cause.

Difficulty of getting correct information. Arthur Road Hospital case.

42. An instance of the difficulty of obtaining correct information occurred on the first day Mons. Haffkine and Mr. Hankin visited the Arthur Road Hospital. A man, a relative of a ghorawalla of Dr. A., had been sent to hospital. He had come from Kurrachee. We were informed by his friends in the service of Dr. A. that he had come from Kurrachee two days before, and that he was ill with fever when he arrived. The case was a very important one because, if true, he might have contracted the disease before arriving in Bombay. We asked the Police to make enquiries, and the information they obtained indicated that he had been four days in Bombay. We saw him in hospital. He was suffering from a mild attack of the disease, although he succumbed afterwards. I drew the attention of Mons. Haffkine and Mr. Hankin to the case, and we commenced to ask questions of him. His replies as to the time he had been in Bombay varied from two days to four months, and when we asked him why it was he gave such conflicting replies, he answered calmly and naively that he was not right in his head, and did not quite know what he was saying.

A patient questioned by Mons. Haffkine and Mr. Hankin. Contradictory statements.

Dengue cases.

43. In July and August cases of dengue fever had been observed. Dr. Smith, R. N., read a paper before the Bombay Medical and Physiological Society on cases that had occurred in the harbour, from which I make the following extract :—

“Here in Bombay we had a well-marked rush of cases in the months of October and November 1895; a second epidemic in July and August 1896; and this last winter in the latter half of November, December, and first half of January, a third. The accompanying diagram shows the wave of prevalence of all



“fevers during the period from my own returns. Surg.-Lt.-Col. Galloway, A.M.D., told me that they had an exactly similar fever very prevalent at Colaba among the Irish Rifles during the early winter months of 1895-96, that is, soon after our first epidemic on board.”

“From my experience it is difficult to find any climatic cause for the outbreaks, the first case being in the hot dry months of October and November, when the ships were out in the stream with abundance of fresh air; the second when they were moored alongside the jetty at Prince’s Dock, in the middle of the wet monsoon; and this last one in the exceptionally cold winter months we have lately experienced. With regard to the latter about 230 men having just come out from England to relieve those who had been out here 18 months; they had passed through Port Said at the time of the above quoted epidemic there, and had been granted leave on shore. Immediately on joining this ship, they, and they only, went down with the fever rapidly, the men who had been out for some time being quite exempt. The type of fever, though very closely resembling what we had experienced before, had points of difference, being much more in accordance with that present in Egypt, chiefly in the presence of a well-marked eruption; so that though the disease is no doubt present in Bombay, and in this hulk, fresh infection seems to have been brought out last autumn, probably remaining dormant until the men reached here, when conditions were favourable for its development.”

44. The difficulties of diagnosing some cases of bubonic plague are well described in a paper read by Dr. Hojel at a meeting of the Bombay Medical and Physiological Society on May 7th.

He writes :

“To-day I should like to read the notes of several cases which I have come across, which I may call (for want of a better term) the ‘Abdominal type of plague.’ These cases too, perhaps, account for some of the increased mortality from remittent fever in the past nine months. In their early stages these cases bear a very strong resemblance to enteric fever, and the differential diagnosis is extremely difficult. I speak now purely from a clinical point of view as regards symptoms and signs, for bacteriological laboratories and apparatus are not scattered broadcast about India; besides which it is a fact that in many cases cultures made from the blood of plague patients prove sterile. It is all-important, therefore, that one should be able to recognize such cases both for the good of the community and one’s own reputation.”

45. Dr. Leumann made autopsies on five of the cases treated in the European General Hospital, and Dr. Hojel writes on them as follows :—

“Clinically speaking, the preliminary stages of all these cases, as was the fact with all those of which I have notes, were all in favour of their being enteric fever, with the exception, perhaps, that in the presence of an epidemic, such as we have had with us, all cases were viewed with more or less suspicion until they were proved to be otherwise than plague cases. The differential diagnosis in these early stages is, to my mind, extremely difficult, and the importance of early diagnosis is apparent to all.”

The first cases.

46. The first cases reported to me seemed, from the description of the symptoms given by the friends, to be cases of diphtheria, and I may not pass over this opportunity of referring to other cases at a later period of a similar character and obscure type.

Distressing type of disease.

Six cases, two of them of a very distressing type, were found in Mazagon on the 24th of February. They were a group of cases in one family that had been brought into Bombay from Thana. One of the family, a child, had died in the train, on the way to Bombay, from bubonic plague. Three of the cases had glandular enlargements around the neck. One of these cases, a female, had enormous œdema of the neck extending down below the clavicles on to the chest and into the axillæ. There was great pressure on the trachea and gasping respiration. She died on the evening of the day I saw her. There was another case with enlargement over the parotid and submaxillary glands. This was a milder case and doing well. Undoubtedly the cases were of plague and yet bacteriologically the results of examinations obtained by two different observers were negative. Professor Bitter, who saw the cases, had no doubt as to the type of the disease, and that it was bubonic plague. They were not dissimilar to the first cases in Mandvi described to me.

Difficulty of recognition. Results negative.

47. How true the words of "Josephus," written long ages ago, when Felix was Governor of Judea, "nor did they die after one and the same manner nor so that it was easy to know what the distemper was."

The cases in Calcutta.

48. The time has not yet arrived to announce the date when the first case occurred in Bombay. We must wait till the experiences of medical men throughout India have been obtained. It is not improbable that when the disease has been more generally recognized and its different types distinguished—for even now some cases are most difficult of recognition during life—it will be found that cases of a disease not dissimilar in symptoms have occurred in periods not very remote, not only in Bombay but in other parts of India. I have no doubt that the cases observed by Dr. Simpson in Calcutta were of bubonic plague.

49. In the Himalayan ranges and lower hills on the Indian frontier, the disease is endemic, and we have to remember that Bombay is in free communication with countries beyond India where the disease is endemic.

Varying forms.

50. The following case treated in the Parel Hospital is of great interest, showing, as it does, the varying forms of the disease and how difficult these forms may at times be of recognition. Dr. Thomson writes :

"The German Scientific Plague Commission experts found plague bacilli " on three different days in the blood cultures, and the day before death and at the " *post-mortem* not a single plague bacillus could be demonstrated in the blood of any " of the organs. Their conviction was that the patient died from the severe " complication, and had his vitality been greater and no complication super- " vened, he would certainly not have died of plague, all the bacilli being destroyed."

51. A very curious case was sent by me from Dongri to Grant Road Hospital ; some medical men present had doubts about the case. The case was of a boy suffering from mycetoma of the foot. He had no indications of bubonic plague, except a peculiar look about the face and a peculiar tongue covered with a white fur. The case was kept under observation. The Russian Scientific Mission made a culture from the foot and obtained plague bacilli. This case afterwards developed an abscess in the liver. An interesting and difficult case.

52. The order in which the first cases in different localities occurred is of much interest. First cases in different localities.

53. On the 10th of August, I heard of two cases of fever with enlarged glands in the neck.

54. The first two cases treated by Dr. Ismail Jan Mahamed occurred on the 21st and 24th August. The patients were Multanis and lived in Broach Street. Both had gone to Nassick on a pilgrimage and had returned four days previous to illness. The first case was seen by Dr. Ismail Jan Mahomed on the 21st, the symptoms being high fever, delirium, lung complications, and small glandular swellings in the right groin.

55. The first case of bubonic plague registered occurred on the 31st of August in Broach Street, the name of the patient was Soonderbai ; aged 25 ; caste Bhansali.

56. In September a Bhattia, suffering from bubonic plague, fled from Mandvi to Naigaum.

57. On the 25th of September, I received a letter from the Acting Health Officer of the Port, in reply to an inquiry from me, to the following effect :—  
“ Not a single case of the character you refer to, namely, fever with glandular enlargements, has been brought to my notice in the harbour up to the present.”

58. In the last week of September, a number of people left Mandvi and went to Walkeshwar to live in the Walkeshwar Temple compound ; two of them died.

59. At the same time many Hindus from plague-stricken localities had gone to the tank at Walkeshwar to have the ceremonies for the dead performed, and food distributed to the Brahmins and the poor. Migration of people and the ceremonies for the dead.

60. On the 5th of October, a case was reported in Peerkhan Lane, 1st Nagpada.

61. The following is a case that escaped from Bombay on the 11th of October, an account of which will be interesting. A labourer, by name P. T., caste Wani Waswul, was living on the north side of Musjid Bridge near the Police chowkey and working in a godown at Colaba. In the afternoon of the 11th October, he felt feverish and afterwards noticed a swelling on the right foot and became anxious to leave Bombay, and sent a telegram to a brother in Dhulia that he was coming to him. He left Bombay on the night of the 11th. On the morning of the 12th, he arrived at Chalisgaon station. There he hired a tonga and on the way became very ill, but he now noticed that a bubo had appeared in the right groin, and, according to the account given by himself to the Flight and the desire to wander.

Doctor at Dhulia, before his death, he was so terrified at the sight of the bubo that he fainted away. He reached Dhulia that evening, and died in hospital on the 14th of bubonic plague. This case illustrates the extraordinary desire to go somewhere or wander anywhere, that came over people suffering from bubonic plague.

62. On the 14th of October, a very suspicious case occurred in Carpenter Street in Magazon, where afterwards a severe outbreak occurred. The patient was isolated.

63. A case occurred also in Kamathipura on the 14th of October.

64. On the 21st of October, two suspicious cases occurred in Khetwady, and in the first week of November three other cases were reported in the same locality.

65. On the 30th of October, two cases occurred in Umarkhadi.

66. In Dhobi Talao suspicious cases occurred.

67. On the 1st of November a girl died in the Dharamsala, Foras Road, of bubonic plague. She had been two days ill, and had not been attended by a medical man.

68. On the 6th of November, a case occurred in Shaik Abdul Rahman Street on the opposite side to the market.

Cases removed from the City to the north of island.

69. In the first week of November, a case was removed from Bhuleshwar to a place as far north as Matunga.

70. A very interesting group of cases occurred in November in Middle Colaba in the ranges of chawls on the Victoria Bunder. These chawls are built on open ground on the sea face and close to mills. Eight cases occurred; of the eight, four were children under 12 years of age, the other four were women working in the spinning department of a mill and not in the godowns. Seven out of the eight cases occurred in one house. The children and women had not been out of Colaba for months.

71. In Khara Talao a case was detected on the 9th of November and sent to hospital.

72. On the 11th of November, a case was reported in Marino Lines, Dhobi Talao.

The first European case.

73. The first case of a European occurred on the 12th of November in the Fort, South. The patient had been to Mandvi, and was said to have been liable to glandular swellings after exertion. He was not of robust constitution. The house in which he lived was a large, ill-lighted building. Dr. Dadsett gave me the following note of the case:—

“ I have the honour to acknowledge the receipt of your letter No. 30499 of 1896-97, and in reply I may inform you that in my opinion the sources from which the late Mr. S. contracted the disease are as follows:—

I. “ Mr. S. had gone to the Argyle Road and its vicinity for the purpose of taking photographs about five weeks ago, and it is possible that he may have

“inhaled bad gases emanating from the drains which were in the course of cleaning at that time. Besides he may have gone in some of the infected houses to take photographs from balconies or roofs.

II. “Mr. S. had been trading as a spirit seller and had his godowns in Kalyan Street, on the Port Trust Estate, and it is possible he may have gone to these godowns during this epidemic, and he may have succumbed to this disease by the same causes, as we find men dying every day, and living in houses built on this reclaimed ground on the Port Trust Estate.

III. “Mr. S. had gone to Poona for a short change, and it is possible he may have moved about the slums of this city, or may have passed by the streets and lanes of this city, and may have contracted the disease.”

Dr. Sydney Smith wrote: “I was called in consultation to see the late Mr. S.”

“In going carefully into the history of the case, I learnt that he had left Bombay for Poona on the previous Friday or Saturday, because he had fever, and he and his mother (who was nursing him), thought that the change might take away his fever.”

“The patient and his mother informed me that the swelling and the tenderness in the left groin made its appearance while they were in Poona, and as his health was not improving, they returned to Bombay on the Tuesday, the day previous to my seeing him.”

“His doctor informed me that he had obstinate vomiting and severe diarrhoea which, however, had been somewhat checked.

“Seeing the gravity of the case (although the patient was perfectly sensible), I recommended that he should be sent to St. George’s Hospital without delay.”

74. A case was reported in Chukla on the 14th of November.

75. On the 21st of November, a case was reported as arising from a rat-bite.

76. In the last week of November, other cases occurred in Umarkhadi. In the end of November, cases had occurred in the north of Umarkhadi section.

77. In November, the outlying districts, south, west and north, had a few sporadic cases for the first time.

78. The desire of the people, when ill, to go somewhere, and especially to their country home, even when their homes were far away, was very remarkable. The same disposition I noticed in Europeans, when ill.

79. In the beginning of December, cases became more frequent in the Fort. In one large chawl in the Fort in which there were nearly 800 people, cases were reported. Before this time a suspicious case had occurred in this building on the 1st December.

80. On the 3rd of December, we knew of cases on the east of the Fort, North. On the 4th of December a case was found on the Port Trust Estate at Mody Bay Bunder.

The order in which the first cases in localities occurred.

81. On the 7th of December, the daughter of a cook in the service of an Officer of the House of Correction was attacked.

82. In the middle of December, a case was reported from Ripon Road, Byculla.

83. On the 13th of December, cases had occurred in the Marine Lines.

84. On the 15th of December, a case was reported in Duncan Road.

85. In the last week of December, cases occurred in Church Street in Mazagon.

86. On the 29th of December, a European living outside Bombay, but coming into Bombay daily on business, was admitted into the European General Hospital suffering from the disease and recovered, but he was a long time in hospital.

87. In the beginning of January, two suspicious cases occurred in Colaba.

88. On the 5th of January, I reported the appearance of cases in localities far distant from the districts already infected, in Worli, at the extreme north-west of the island and in huts in Narelwady, Mazagon.

89. On the 18th of January, a case occurred in Upper Colaba. The patient was at once removed by us to hospital, although the parents objected to the case being removed.

90. On the 18th of January, a woman was found dead in an empty stable on the Walkeshwar Road, and we had to remove the body.

91. A case occurred on the 25th of January, on Mori Road, Mahim, in a hut occupied by Kolis. This was the first case here for a fortnight.

92. Up to the end of January, six cases had been reported of soldiers from the 21st Regiment, and one other case of a servant.

93. Towards the end of January, we ascertained that cases were being brought into Bombay from Bandera and Andheri.

94. On the 4th of February, a case occurred amongst European soldiers. He was a Gunner stationed in the Mahalakshmi Fort, and he was removed to Colaba and segregated in a tent. In this case, there were two enlarged glands, both on the right side, one in the right groin and the other over the right parotid.

95. On the 5th of February, two suspicious cases were reported from Upper Colaba.

96. On the 9th of February, cases were reported from Jacob's Circle.

97. A case occurred on Bhundarwada Hill on the 9th of February.

98. In the second week of February, a case occurred in the Bandra Slaughter House compound. Isolation sheds were put up and an Hospital opened at once.

99. On the 19th of February, cases occurred near the huts occupied by our scavengers in Upper Mahim.

100. On the 24th of February, cases were detected in Albion Place, among relatives of cooks, and, strange to say, we observed that the people allowed their cooks to attend on the sick, and at the same time to cook their food.

101. On the 24th of February, cases occurred in huts outside the Lunatic Asylum at the extreme south of the island.

102. On the 24th of February, a case occurred amongst the Kolis in Upper Mahim.

103. On the 27th of February, cases were occurring in Mahalakshmi Temple compound.

104. Towards the end of February, cases were reported from Cumballa Hill.

105. In the last week of February, we discovered that people ill from bubonic plague were being brought in secretly from Bhiwandi, part of the way by sea, into Bombay.

106. Between September and the 17th of February, 100 suspicious cases from Bombay were stopped at Poona.

107. On the 8th of April, the first case occurred in the Port Trust, Warden chawl.

108. On one of the floors of a house in which was a school, a case occurred. The school was in charge of two European ladies. As soon as they heard of the case, they sent for a Police sepoy and placed him on the front door to watch it and prevent the case escaping, and they telephoned to me. There was, however, a back door of which the ladies did not know, and on which no one was placed to guard it; by this door the patient escaped. After a long search I traced the patient to another house.

109. The objections to opening schools in buildings used as dwellings came often, even as early as in September, under our observation. One of the tenants in premises, a portion of which is used as a Municipal School, died of bubonic plague.

110. In the course of the disease it is very remarkable the distance and number of the places to which numbers of wealthy and even poor people fled.

111. In the beginning we telegraphed to Lanowli and other places giving information of people who had escaped from Bombay, and where they were supposed to be going. Information of cases leaving Bombay telegraphed by us.

112. The first imported case noticed in Lanowli was reported on the 14th of October. The first indigenous case in Lanowli occurred on the 17th of April; but it occurred a little outside the bazaar, and there was, as far as I could ascertain, no history and no suspicion of any recent case of importation.

113. The period of incubation in some cases appeared to be under two days.

Importation of  
cases by sea.

114. Two very interesting cases were imported by sea. One case, a steward, who came direct in a steamer from Suez, landed, suffering from slight fever; but afterwards the characteristic symptoms of bubonic plague appeared with enlargement of the glands on the right side of the neck. Temperature 105; respirations 55 at time of admission. The steamer had touched at no places between Suez and Bombay.

115. Two other cases (a) (b) I may refer to, both of which came from Assam to Calcutta and from Calcutta to Bombay by sea. The day after arriving in Bombay they suffered from slight fever, and made up their minds to leave Bombay and go to Kurrachee. With this intention they took passages for Kurrachee and went on board the steamer. There they were examined, detained and sent to the Segregation Hospital in Reay Road.

(a) Temperature on admission 100. Enlarged glands in the right groin.

(b) Temperature 100·6. Enlarged glands in the right groin.

Both cases were afterwards removed to hospital.

116. A passenger, Mr. 'A.' on board the S. S. \* \* \* \* who had been to England for six months, was returning to Bombay in November. After leaving Suez, he suffered from fever, accompanied by pains along the chain of glands and enlargements in the right groin. The case was not considered by the doctor of the ship or by the late Doctor Manser to be one of bubonic plague, but Doctor Childe, who was called in consultation, pronounced it to be one of bubonic plague.

117. A very peculiar case occurred in June 1897, of a Goanese waiter on board the S. S. \* \* from England. When he arrived he was ill, and two days afterwards the characteristic symptoms of bubonic plague appeared. There was a glandular enlargement on the right side of the neck; temperature 105°, respirations 50. The steamer by which he came had come direct from Suez.

Recurrence of  
cases.

118. The following cases in Dongri street, where there was a recurrence of cases after an interval of remission varying from two to six months, are amongst the most interesting of the instances of recrudescence:—

Dongri Street, 339-349—First case 23rd September, last case 8th October. Recurrence first case 30th November.

Dongri Street, 394-398—First case 23rd September 1896, last case 4th October 1896. Recurrence first case 5th April 1897.

Dongri Street, 122-130—First case 27th September 1896, last case 15th October 1896. Recurrence first case 6th November 1896.

Dongri Street, 475—First case 29th September 1896, last case 4th October 1896. Recurrence first case 3rd March 1897.

Dongri Street, 369-375—First case 1st October 1896, last case 21st October 1896. Recurrence first case 24th March 1897.

Dongri Street, 102-106—First and last case 3rd October 1896. Recurrence first case 5th March 1897.

Dongri Street, 490-498—First and last case 6th October 1896. Recurrence first case 23rd December 1896.

Dongri Street, 33-39—First and last case 3rd October 1896. Recurrence first case 29th March 1897.

Dongri Street, 357-391—First and last case 28th February 1897. Recurrence first case 26th March 1897.

Desouza Street, 62-72—First case 21st September 1896, last case 29th September 1896. Recurrence first case 12th March 1897.

Desouza Street, 71-73—First and last case 24th September 1896. Recurrence first case 17th February 1897.

Desouza Street, 136-140—First and last case 5th November 1896. Recurrence first case 15th December 1896.



119. To indicate how often different opinions were arrived at in regard to the pneumonic type of the disease and the measures to be adopted, I quote the following extract from a report of one of the medical officers :--

"I visited the patient last evening with Dr. A. In his position as a friend of the family, irrespective of my opinion, this gentleman also concluded it to be one of bubonic plague. He is fully acquainted with the disease and is a practitioner of experience. Under such circumstances the building was ordered to be put into disinfection and the process was adopted without delay. This morning Dr. B. has apparently changed his mind about his previous suspicious diagnosis, and characterizes the case as one of pneumonia and bronchitis, or, I presume, broncho-pneumonia." Different opinions about a case.

120. One day in Kamathipura while the Volunteer Artillery were doing splendid service, we were examining a house in one street in which deaths had occurred. The inner rooms were in total darkness. We stood in front of one of the rooms in which we were told there was no one. As we stood by the door, we heard a moan. We forced the door open and found a woman inside with high fever. A concealed case.

121. In another house in Kamathipura we discovered in a closed room with the door locked, a man who was very ill; he had been locked up in the room the previous night by a relative, and this friend had gone away and not come back. The sick locked up.

122. One of the first women sent to the Arthur Road Hospital was found in this way. I was inspecting in Mandvi a chawl in which a death had occurred, and some of the people in the building told me that there was a woman who was mad in one of the rooms, and that there had been nobody to do anything for her, not even to feed her for two days. I went into a room pointed out to me; the room was in complete darkness and after a light had been brought I found a woman inside lying on the floor in high fever and delirium. She was in a horrible state from neglect; she had a tongue very much like that of a typhus fever case. I removed her to hospital that night, and although a very bad case, she recovered. One of the first cases sent to hospital found in a room in complete darkness.

123. On one occasion in Kamathipura an incident, at once ludicrous and pitiful, occurred. A boy, a Hindu, had been living in a Parsi family, he contracted the disease. He was in a house near the entrance and on the way to one of our stables. We made the usual arrangements for the removal of the boy. The family in which he lived were much attached to him. As soon as the Health Department Inspector told the family that the boy would be removed to hospital, the Parsi ladies objected and exclaimed that they would not permit the boy to be removed; and before the lad could be removed 13 Parsi ladies surrounded the bed, and with knives in their hands shouted that they would kill themselves if the boy was removed. The affair was telephoned to me in office. The Assistant Health Officer and I directed the Police to be sent for, and the Officers of Police came. By this time a large crowd had collected, the street was full of people, and the streets converging were thronged with great crowds. The crowds were kept back from the house, but the Police and the Health Department had formidable opponents in 13 Resisted by women. Death of a boy. A scene.

Parsi ladies, who threatened to take their lives if the boy was removed. It was now long past dark and we decided to wait till next morning, and next morning when I came to see the boy he was dying. He died while I was in the room. This is an instance of opposition met with, yet the boy was a Hindu and the family were Parsis.

**Curses on us.**

124. On another occasion we were followed through the streets by an old woman with her hands up who called down curses on our infamous duties.

**Rapidity of death.**

125. In removing patients to hospital I saw many appalling instances of the rapidity of the disease and the suddenness of death. On one occasion I saw an opulent Hindu in a crowded house, and I was asked whether he should be removed or not. I directed that he should be removed, but we did not tell the patient nor his friends. We thought we had better not till the ambulance came. I left for office, and before half an hour had passed and before the ambulance had come, I was told that he was dead. One felt thankful and had a feeling of relief that the sufferer had not been told that he would be removed to hospital and his last moments disturbed by fright.

**Escape from an Ambulance.**

The following pitiful case shows how difficult it is to deal with the disease. A man came walking to the J. J. Hospital for treatment. On examination he was found to be suffering from bubonic plague. The hospital authorities sent for the Municipal ambulance van. The patient stepped into it. On the box, by the side of the driver, sat a sepoy. The ambulance was driven off. It arrived at Parel Hospital, but when the door was opened there was no one inside. The patient had opened the door and jumped out on the way. Information was telephoned to me and I telephoned all over the city, as I had no doubt the unfortunate man would be found lying somewhere. In the evening he was found lying dead in a verandah, having walked a long way, from one district to another.

126. While appalling scenes were frequent, yet there were many ludicrous incidents.

**An Ambulance scene.**

127. Here is what I saw one morning in the street behind the Municipal stables and running past the end of the chawl occupied by Municipal sweepers. The Municipal ambulance carriage was standing in the street. In a verandah lay a boy, unconscious, and apparently dying. As I came up he was being lifted into the ambulance. By the door of the ambulance stood one man, and two men lifted the boy into the ambulance. Before he was placed inside and before the hands that were joined underneath in lifting him had parted, he suddenly sat up, jumped on to the ground and ran away up a narrow gully. We followed him and caught him in a passage, and to our surprise found he was not ill from plague. Apparently he was liable to fits of unconsciousness in one of which he had fallen on the verandah and been caught by us.

**Street scenes  
Dead people in the streets.**

128. In the papers there used to appear harrowing accounts of dead people seen lying in the streets. Very many of these people revived and recovered though many could not be roused from unconsciousness; whether it was the weariness of the panic, but I have never seen so many people at any other period lying on the sides of the streets.

129. The desire to wander—the delirium of the disease is very strange and pathetic. A patient, with a temperature of over 100°, suddenly becomes influenced by this desire to wander. He leaves his house, and if he is wealthy, he drives to a Railway station and tries to proceed to some place, and he cannot tell you why. I noticed this desire to wander in all classes, and it often precedes high fever and delirium. Desire to wander and delirium.

130. The rapidity with which the temperature rises is very remarkable. The following case was one of most rapid development. A coachman in the service of Government was apparently quite well and at work at 2 o'clock. He afterwards complained of pains in his head and body. He laid down, rapid fever came on, and at 5 o'clock, on the same evening, he died. Rapidity of rise in temperature.

131. In September I drew the attention of the Assistant Adjutant-General to the danger which might arise from men going out at nights to kill rats on the Port Trust Estate. Rats, killing of.

132. It is of great importance that all information available of the mortality amongst rats during this period should be placed on record. I shall now briefly review the information recorded in this office. Rats, mortality of.

133. On the 1st of October I received information of rats dying in Dongri, over this district generally rats died in the last week of September.

134. On the 1st of October large numbers of rats appeared in Tardeo in houses where rats had never been seen before.

135. On the 1st of October we received a letter from a pharmacy to this effect :—“As some connection is suspected between the outbreak of the plague at Mandvi, and the appearance of rats in that district, I beg to inform you that our house has been visited by an unprecedented number of rats. Till a fortnight ago, it was remarkably free from them, but during the last two weeks we have killed nearly half-a-dozen of them, while many of them have escaped the same fate. This circumstance may have little significance, yet I consider it my duty to call your attention to it. Some time ago the stench issuing from the gutters was insufferable, but at present it does not trouble us.” Dead rats in a pharmacy.

136. In October I enquired whether an unusual number of rats had been carried in the sewage to the shred-lifters at Love Grove Pumping Station. I thought it possible that dead rats in large numbers might have been carried down the sewage, but the information I received was that very few had been noticed. I also made enquiries as to whether any unusual number of dead rats had been seen on board the ships in the harbour, but they had not been observed. Dead rats in the sewage not found in numbers.

137. In October, dead rats were observed in Bhuleshwar. On the 23rd of October attention began to be attracted to dead rats in buildings in this locality.

138. On the 27th of October rats were found dead in buildings on the Apollo Bunder, and Mr. Hankin drew my attention to a matter of great importance—the odour from excavations behind the Annexe buildings of Watson's Hotel, Apollo Bunder—and I wrote to the Engineer at once, in respect to it, but he informed me that he could not, under the Municipal Act, interfere. All I could do was to disinfect the earth.

139. Very often people by drawing our attention to dead rats rendered a service to a locality; for instance, in a group of buildings in Matharpakady, dead rats were found, and we disinfected the buildings and the locality; afterwards only seven cases occurred in the place.

Dead pigeons.

140. On the morning of the 9th of November, Inspector Hallums found 5 dead pigeons in Surat street, and on the evening of the same day he found 9 more, and on the 12th he picked up 5 in the same street.

141. In one godown we were disinfecting in Musjid Bunder Station Road, 25 dead rats were found. Over this building 7 cases of bubonic plague occurred.

142. In November, alarmed complaints were made of the nuisance from a large number of rats dying in the Girgaum district. The disease became prevalent in this district in the end of December.

143. On the 7th of December we obtained information that rats had appeared in large numbers in Jairazbhai street in Kamathipura section. On the 10th of December rats were found lying dead in the Marine Lines and in Dhobi Talao near the Marine Lines.

144. In December dead rats were found in the north of the island, where plague, as we were informed in a petition, had extended its "deadly paws north of Mahim."

145. There are numerous instances of the disease amongst rats, preceding the disease amongst human beings. I give a characteristic case. In a stable attached to the residence of a medical man, Dr. H., dead rats were found, the building and place were thoroughly disinfected, the tiles taken off the roof, but a coachman, who slept on the floor of the stable, became ill three days afterwards and died.

146. In January it was reported that rats were dead in shops in the Fort, North. From the Fort, North, on the 7th of January, I received the following letter:—"We have the honour to inform you that some rats were yesterday found dead on the first floor of the house No. Meadows Street, and hence it is necessary to have the whole premises disinfected, as our office is situated on the second story."

Dead and sick cats.

147. A large number of dead and sick cats were observed in January. Some of the sick cats were examined bacteriologically, but the results were sterile.

148. On the 25th of January I received the following report from Dr. Jennings:—"I have observed a large number of dead and sick cats about, and am of opinion that these animals are being affected with some disease of the nature of the plague. It would be advisable to suggest to the Police, that some measure should be adopted for the destruction of these animals and the cremation of their bodies. Inspector Hallums would be able to point out a large number that he has observed."

149. In February, in Bhoiwadi, I found a cat suffering from a disease that appeared to be bubonic plague with enlarged glands on both sides of the neck.

150. In the Fort on the 16th of February in one of the offices a cat died, and another cat was ill with fever.

Hence in

151. On the 16th of February it was reported to me that rats were dying in numbers in Upper Mahim, Gopi Tank.

152. On the 20th of February, it was again reported that a number of dead rats had been found in the Fort, 20 having been taken out of one building.

153. The following case that occurred in the beginning of March will be of interest :—“ Three days ago my servant was taken bad with fever and indications of plague, and on my opening a side room near where he sleeps, I found a large dead rat. My servant had been removed, and I have had the rooms disinfected, but on entering the bath-room this morning, I found another dead rat.”

154. As the epidemic proceeded, people became alarmed in regard to the danger indicated by dead rats, and they commenced to write to us, in the following strain as this letter will show :—“ As some dead rats are found in the house I am living in, and as I am afraid that it is infected with the plague, I want to vacate it temporarily and live in some sheds ;” and the letter finishes with a request to occupy some Municipal land.

155. In August there was a great increase in the mortality amongst cattle and sheep and goats. It will be observed from the table hereafter printed that there had been from July an increase in the number of dead animals removed. The small increase in the number of dead cats removed in July and August shown in the table will be observed. It will be observed that the mortality amongst horses decreased in these months.

Statement showing the number of dead animals removed from May to September 1896.

Months, 1896.	Bullocks.	Buffaloes.	Cows.	Horses.	Cattle.	Goats & Sheep.	Dogs.	Cats.	Other animals.	Total.
May ... ..	34	28	17	59	410	66	325	36	9	984
June ... ..	42	30	15	51	456	67	282	34	13	990
July ... ..	38	31	11	29	712	88	184	41	19	1,153
August ... ..	47	30	22	23	817	117	224	44	18	1,395
September ... ..	48	33	16	31	733	104	206	36	9	1,216
Total ... ..	209	152	81	193	3,181	442	1,221	191	68	5,738

156. In order to form a just opinion on the momentous events through which this city has passed, it is right to study the accounts transmitted to us of the great historical epidemics of Bubonic Plague.

The historic progress of Plague.

157. From the earliest times the communication of a contagion from the disease has been asserted with confidence or denied with vigor. The information that the ancients derived from long experience, although less exact, is not in some respects greatly inferior to the knowledge which we have obtained by experiment.

In the earliest ages it was observed that in some epidemics and at some periods, the disease was highly contagious while in other years and at other times of its appearance, the malady was slightly, if at all, spread by human intercourse. The different types of the disease suggest the true explanation of these various and conflicting opinions.

158. The laws of Moses seemed especially directed against plague in Egypt. They prescribed the eating of food that was not raw nor sodden at all with water and of bread that was unleavened.

159. The further precaution is a most remarkable one :—

“And ye shall let nothing of it remain until the morning; and that which remaineth of it until the morning ye shall burn with fire.”

160. And finally the Israelites went out of Egypt, the land of plagues.

161. The laws of Moses directed against leprosy were in their ordinances equally good for the prevention of the spread of plague.

162. The events that preceded plague in the time of King David appear to have been :—

I. A great increase of population.

II. A desire to know the increase of population.

III. The plague.

163. And lastly the plague was ascribed to the measures taken by the King. In Bombay the plague was popularly ascribed to measures that had been taken by the Municipality.

164. It is evident that the Israelites had greatly increased in numbers, and that the King had a natural desire to number them.

165. It is remarkable how the many and varying forms of the disease were recognized by Josephus. How vivid and true seems the following description of the plague in the time of King David :—

“Nor did they die after one and the same manner, nor so that it was easy to know what the distemper was. Now, the miserable disease was one indeed, but it carried them off by ten thousand causes and occasions, which those that were afflicted could not understand; for one died upon the neck of another, and the terrible malady seized them before they were aware, and brought them to their end suddenly, some giving up the ghost immediately with great pains and bitter grief, and some were worn away by their distempers, and had nothing remaining to be buried, but as soon as ever they fell, were entirely macerated: some were choked and greatly lamented their case, as being also stricken with a sudden darkness; some there were, who, as they were burying a relation, fell down dead, without finishing the rites of the funeral. Now there perished of this disease, which began with the morning and lasted till the hour of dinner, seventy thousand.”

166. Bubonic plague seems to have been known in Africa since the 3rd century.

167. The great pestilence in Athens of which Thucydides has left a description was in its symptoms very much like plague. In this great epidemic a question which is even up to now warmly debated—the contagiousness of the disease—was disputed. The pestilence in Athens.

168. A brief commentary on the pestilences that have afflicted the world would be incomplete without a reference to the description by Gibbon of the great plague that depopulated the world in A. D. 542.

169. Gibbon writes :—“Æthiopia and Egypt have been stigmatised in every age, as the original source and seminary of plague. In a damp, hot, stagnating air, this African fever is generated from the putrefaction of animal substances, and especially from swarms of locusts, not less destructive to mankind in their death than in their lives. The fatal disease, which (A. D. 542) depopulated the earth in the time of Justinian and his successors, first appeared in the neighbourhood of Pelusium, between the Serbonian bog and the eastern channel of the Nile. From thence tracing as it were a double path, it spread to the East, over Syria, Persia, and the Indies, and penetrated to the West, along the coast of Africa and over the Continent of Europe.” Gibbon's description of the plague in the time of Justinian.

170. How true is the following passage after so many years :—

“The infection was sometimes announced by the visions of a distempered fancy, and the victim despaired as soon as he had heard the menace and felt the stroke of an invisible spectre. But the greater number in their beds, in the streets, in their usual occupation, were surprised by a slight fever ; so slight indeed, that neither the pulse nor the color of the patient gave any signs of the approaching danger.”

“The fever was often accompanied with lethargy or delirium ; the bodies of the sick were covered with black pustules or carbuncles, the symptoms of immediate death ; and in the constitutions too feeble to produce an eruption, the vomiting of blood was followed by a mortification of the bowels. Youth was the most perilous season ; and the female sex was less susceptible than the male.”

171. Then follows a description of the *pneumonic* type of the pestilence—

“Contagion is the inseparable symptom of the plague ; which, by mutual respiration, is transferred from the infected persons to the lungs and stomach of those who approach them. While philosophers believe and tremble, it is singular that the existence of a real danger should have been denied by a people most prone to vain and imaginary terrors.”

172. Gibbon adds in a foot-note—

“Mead proves that the plague is contagious from Thucydides, Lucretius, Aristotle, Galen, and common experience (p. 10): and he refutes (preface p. 11) the contrary opinion of the French physicians who visited Marseilles in the year 1720. Yet these were the recent and enlightened spectators of a plague which, in a few months swept away 50,000 inhabitants (*sur la Peste de Marseille, Paris, 1786*) of a city that, in the present hour of prosperity and trade, contains no more than 90,000 souls. (*Necker sur les Finances, i 231*).”

173. This portion of the Report would not be complete without a reference to the loss of life in that great epidemic. Gibbon writes :—" The triple scourge " of war, pestilence and famine, afflicted the subjects of Justinian, and his reign is "disgraced by a visible decrease of the human species, which has never been "repaired in some of the fairest countries of the globe."

Famine and plague  
in Syria.

174. The famine of A.D. 639 was followed by a great outbreak of plague in Syria, from whence it spread. We read that: " High and low fell quickly before " the scourge, and men were struck down as by a sudden blow, and death followed " rapidly." One of the most effectual measures adopted by Abu Obeida, the great Arab General, was the removal of the people from the cities to the highlands.

English outbreaks.

175. In 1361 and 1368 the second and third great plagues of England occurred. In 1563-64 a disease like the plague killed large numbers of people in England, and it is stated that in one churchyard in London as many as 50,000 were buried.

176. In 1663 another epidemic of plague occurred in England; and I need not describe the great epidemic of 1665 of which De Foe has left a description.

Modern name in  
the Himalayas.

177. The modern name by which bubonic plague is known in the Himalayas is *phugya rog*. In the *Tarikh-i-Ferishtah* the *taun* is described.

178. It is remarkable that after the year 1666 the disease gradually disappeared from England, although epidemics occurred in different parts of Europe.

179. In 1684 the disease was observed in the army of the Emperor Aurangzebe, and this epidemic was followed by a famine.

180. In 1689 the disease again appeared in the camp of the Emperor at Bijapur, and an occurrence was witnessed when the Emperor was being carried to prayers, exactly the same as occurred long years before in Rome. Some 70 people accompanying him died.

Escape of Europeans  
in Surat.

181. It is very remarkable that in Surat during the epidemics of 1684 and 1690 the Europeans escaped the disease.

Outbreak in Bulsar.

182. In Bulsar, where in 1897, there have been many deaths from bubonic plague, there was a severe epidemic in 1691.

Outbreaks in  
Bombay.

183. In 1689 to 1690 the disease appeared in Bombay and in 1702 it was again known in this City.

184. Mr. Barrow has prepared some interesting notes on the historical epidemics of plague in India, to which I am indebted for information.

Extract from Bruce's  
Annals.

185. Mr. Barrow has given me the following extract from *Bruce's Annals*, vol. 3, page 502 :—

" I may mention that, to add to the distress of the people, a violent tornado " followed this pestilence, destroying the produce of the land and wrecking the " greater number of armed and other vessels in harbour, and that the Government, " whilst preparing to meet another invasion, were annoyed by their old foes, the " Portuguese, who gave secret assistance to the other enemies of the Bombay " Government."



186. Sir James Campbell in the *Bombay Gazetteer* has a note on the outbreak of plague and pestilential fever in Bassein in 1690.

*Gemelli Careri in Churchill's Voyages IV*, 191.—“ This outbreak, apparently Extract from Bombay Gazetteer. ly the true plague, *taun* and *waba*, raged for several years over a great part of Western India. At Ahmedabad, where it lasted for seven or eight years, its visible marks were swellings as big as a grape or banana behind the ears, under the arms and in the groin, and redness round the pupils of the eyes. In 1689 it broke out with great violence at Bijapur. All attacked with it gave up hope! It had been in the Deccan for several years (*Muntakhabu-i-Lubab* : Elliot, vii, 337). Near Goa, in 1684, it attacked Sultan Mosam's army and carried off 500 men a day (*Orme's Hist. Frag.*, 142); raged in Surat for six years (1684-1690), (Ovington's *Voyage to Surat*, 347); reduced (1690) the Bombay garrison to 35 English soldiers (*Bruce's Annals*, iii, 94); was so violent that it not only took away all means of preparing for a good end, but in a few hours in Surat, Daman and Thana carried off whole city full of people (*Churchill*, ix, 191), and at Tatta in Sind (1696) killed 80,000 souls (*Hamilton's New Account*, I, 123).”

187. In 1690 to 1700 Sir James Campbell, quoting *Bruce's Annals*, Anderson's *English in Western India* and *Hamilton's New Account*, writes :

“ Bombay was in no state to receive an envoy ‘ either by the appearance of its strength, or by having disposable shipping for the service solicited.’ The unfortunate ‘ Isle of the East ’ was plague-stricken, empty, and ruined. Of 800 Europeans, only 50 were left—6 civilians, 6 commissioned officers and not quite 40 English soldiers. There was only one horse fit to ride and one pair of oxen to draw a coach. Bombay, that had been one of the pleasantest places in India, was brought to be one of the most dismal deserts.”

It appears that about 1695 “ a plague, a pestilential disease, called carazzo exactly like a bubo, had for some years infested the north coast; cities were emptied in a few hours; Surat, Damaun, Bassein and Thana had all suffered.”

188. In 1812, the disease was prevalent in Guzerat, and was reported in Meywar; and the city of Bombay feared then, as it fears now, an immigration of destitute persons into the city. Mr. Balla, at the Grand Jury, alluded to it in his presentiment.

189. In 1813, the disease appeared in Cutch, Kathiawar and Rajputana and spread to Sind.

190. In 1836-37 it appeared in the Jodhpur State, and it was apprehended that it would spread to Bombay.

191. The following description by a chaplain to the British Embassy of the dread excited by the appearance of plague in Constantinople, in the beginning of the century, conveys an idea of the despair and horror induced even then by the spread of the pestilence:—

“ It is impossible to give you an adequate idea of the alarm which the The plague in Constantinople. disease excites here. Its ravages have been so great, that it is looked upon, even by enlightened Europeans, with the same hopeless terrors as in the darkest

“ages of ignorance and superstition. When any person is seized with it he is abandoned to his fate even by his nearest relatives ; no medical man will dare to approach him on pain of being himself shunned and ruined.”

Experiences of one  
ill and in the  
mountains.

192. Here is the experience of an Englishman, the Rev. Mr. Walshe, while suffering from plague in another part of the world in the Levant:—“I now found myself utterly alone, deserted by all the world, in a solitary spot among woods and mountains. I know not how long I continued in this condition, but the first returning sensation was caused by the sound of a horse’s hoofs clattering along. I found it proceeded from that of a Janissary whom Lord Strangford had despatched with all speed to look after me when he heard I was abandoned and alone ; had it not been for him I should have remained all night where I lay exposed to the inclemency of the weather. He took me in his arms like a child, brought me in, and laid me in bed.”

Inoculation against  
plague.

193. Inoculation against plague seems to have been known to the Greeks from an early age.

Virtue in a bubo.

194. There was a curious belief in regard to the virtue there may be even in a bubo:—“When a bubo suppurates, there sometimes protrudes from it a quantity of fungous flesh, to which the Greeks attach a singular virtue. They imagine whoever wears a portion of it about his person, particularly if it be extracted from the ‘King Pest,’ will never take the plague, and hence it is carefully cut out, and the disgusting antidote is sold as a precious charm.”

Contagion—views on.

195. The views held on contagion in the Levant a hundred years ago are interesting. Walshe writes:—

“It is usual here, as elsewhere, to strike hands, in order to confirm a bargain, but personal contact was at this time deemed highly dangerous, and no man would touch his neighbour ; but the bargain must be ratified, so a stick was brought, and each of the contracting parties holding the ends of it, the affair was concluded. I was here informed of the graduated scale on which infection proceeds and the comparative danger of various substances. Besides those which were usually admitted as susceptible, all kinds of woollen and cotton clothes, there was an infinite variety in the gradations of hazard in other things. Cats and rats were conductors, but dogs and horses were not.”

Acids as disin-  
fectants.

196. Money was generally immersed in vinegar or some other acid.

197. The knowledge of the action of acids in destroying the contagion had been handed down from early times.

Inoculation. “King  
Pest.”

198. Inoculation had even then been tried as a prophylactic, and, where the disease was supposed to have entered the system, a boil, it was imagined, appeared, which was called “King Pest.” The matter from this boil was inoculated.

199. So strong were the opinions in the beginning of this century on the question of contagion that a Dr. Maclean “proceeded to Constantinople under the direction of the Levant Company, and instead of flying from a disease which everyone else looked on with such hopeless terror, he shut himself up in the

“hospitals along with infected patients. There are two plague hospitals—one near the Seven Towers in Constantinople, in a low, unhealthy situation; the other on an elevated site in Pera, on the high grounds above the Bosphorus. It was into the former the Doctor entered, with a firm impression on his mind that the disease was not contagious, and a design to convince others of the truth of his theory.”

200. And here experiences repeat themselves. “His experiment was unfortunate—he caught the disease in the hospital. He escaped death, but with an extraordinary pertinacity of opinion he persisted to affirm that it was not contagious, but communicated to him by the marsh miasma in the vicinity of the hospital. Whatever opinion he entertained of the result of these experiments, there can be but one as to their motives. A more intrepid or disinterested devotion of self in the cause of humanity is not to be found in history. Nothing could abate his conviction of non-contagion and the absurdity of quarantines. I met him with a broken constitution, hastening to his last home, but he was still as sanguine as ever that he would live to benefit the world by some extraordinary improvement in the management of this terrible distemper, and he died, I was informed, in this firm conviction.”

201. Mr. Barrow, our Secretary, has prepared for me the following note on the publication of mortuary statistics in London. It is of much interest :—

“To the recurrence of plague in London is attributed the first publication or the “Bills of Mortality” in 1592; the object being to lessen the evils of exaggerated rumour and to warn those who could conveniently do so, to leave London, whenever the pestilence became more fatal than usual. But it was not until 1603, when the disease was again raging, that the publication of the Bills became regular and uninterrupted. With the growth of London they become unreliable, and from about 1840, were in effect superseded by the returns of the Registrar General, whose office was created pursuant to the Acts VI and VII, William IV, c 86—*Wharton’s Law Lexicon.*”

202. The people did not, and could not, believe that the disease was as dangerous as we pronounced it to be. The people and the Plague.

203. The people had been demoralized by the success we had in dealing with infectious diseases. They expected that the new disease would be stopped as readily as cholera had in all former years been eradicated by our measures. People demoralized by the success of the Health Department.

204. The people here had no conception of the sacrifices willingly made in European cities for the prevention and suppression of infectious diseases.

205. Even in a free country like America, and in the city of Boston, I find the following regulations in respect of the isolation of children suffering from infectious diseases adopted :—“2.—Every parent or guardian of any child or ward infected with small-pox, scarlet fever, diphtheria, or membranous croup shall immediately cause such child or ward to be conveyed to some isolated place or room approved by the Board of Health, and no parent or guardian shall permit such child or ward to remove from such place or room until the Board of Health Regulations in America for dealing with infectious diseases. Boston.

shall find and certify in writing that all danger of communicating such disease to others has passed. 3.—No person, other than the attending physician, nurse, and agent of the Board of Health, shall enter any apartment or other place set apart for the treatment of small-pox, scarlet fever, diphtheria, or membranous croup until the Board of Health shall certify in writing that such apartment or place has been satisfactorily disinfected.”

Opposition to killing animals, &c.

206. Such a pass had we come to, that picking up a few sick pigeons caused excitement and nearly led to a riot, and peaceful Banniahs, for 10 sick pigeons, threatened to raze the city. Even the position of a dustbin was considered of public importance. All our attempts to kill or catch rats were opposed or threatened. It is difficult to persuade a people with more regard for the lives of animals than for the safety of their own kindred, that it was right to kill or capture animals either to stay the pestilence or to obtain a knowledge of the disease. I had hopes in September that a microbe, which Professor Hankin had a supply of, would, when cultivated, develop and destroy rats, but on being tried it was inert. We offered rewards for all dead rats found, and very general measures were taken to destroy rats and burn the dead ones. But soon the rats became scarce, or were not to be seen outside. While the rats were sick in Mandvi, the mice were unaffected and in our office in that locality the mice, when rats could not be found in the district, were numerous and lively.

Dead rats.

Mice lively while the rats were sick.

Opposition to the capture of rats, monstrous tales believed

207. So bitter was the opposition to the capture of rates that monstrous stories were invented of our officers throwing live rats on the fires as if to give pleasure to men tired and weary, and knowing the danger of handling rats, doing what they need not do even if a sense of humanity did not forbid them. And so events proceeded, we were opposed on all sides, whether in the treatment of buildings, in the treatment of human beings, or in the treatment of animals. People whom we found sitting up and whom we begged to lie down, even before we left their doors, were again sitting up, and more than once before we left the building, we heard that they were dead, as Dr. R. often said to me: “It is useless to give advice to the people.”

Sitting up. Neglect of advice.

Measures opposed to customs, &c.

208. We had to deal with some people more careful of the lives of animals than of their own. We had to carry out measures opposed to the interests, the customs and the dearest feelings of some classes of the people: 1. To clean out houses when the people themselves would not either clean the houses or employ others to do it. 2. To remove the sick. 3. To burn or expose to the sun all articles likely to have been infected.

Difficulties. Cleaning out buildings.

209. In one of the first letters I wrote which was read to the Committee appointed by Government, I asked: “(a) Am I, when Musalman or Hindu scavengers cannot be obtained, to clean the inside of buildings occupied by tenants, to forcibly enter with the scavengers of the Health Department who are *dheds*? (b) Rooms over godowns cannot be cleansed and disinfected without injuring grain in the godowns. I have caused a great deal of damage in that way. Am I to be held blameless?”

Tenacity.

210. In the large buildings in Mandvi the tenants would not employ people to clean down the passages and spaces outside the rooms, as they said it was the

duty of the landlords. They maintained that the landlords should do it, and we could not find the landlords. The Jains and others are a people very tenacious of their rights.

211. People in these and other crowded buildings complained of everything outside and of nothing inside their dwellings ; to them a few leaves in a street or gully were a serious object of complaint, but the nuisances outside their own rooms and inside their houses they preferred to bear with rather than save the landlords the trouble of doing what they thought the landlords ought to do. It is a most serious defect in the law that there is no provision to compel landlords to employ an establishment to keep their houses clean. Tenants who would rather live in dirt than do what they thought the landlords should do.

212. On many occasions the ambulance vans were damaged even after the Plague Committee had been formed. One of my first duties in March was to go down to Falkland Road, as it had been telephoned to us that a large crowd had collected and stoned the ambulance van. On the way I sent Assistant Surgeon Pettigrew to bring up a detachment of soldiers from the Northbrook Garden. I found a very large crowd in the street, every lane being filled, and the soldiers had to drive the crowd back. Attack on ambulance vans.

213. Whether at the railway stations or in the city, nearly every hand was against the Municipal Officers simply because people did not, and would not understand that the disease was contagious. General opposition.

214. To show what strange customs prevail, I need only refer to the defence put forward in the Police Court in a case where cows were kept on the ground floor of a dwelling. The plea urged was that the cows were kept for religious purposes, the ladies of the household having to worship them in the morning. I believe the plea was true. Opposition on religious grounds. Case in point.

215. From an Insurance Company I received this communication :—"We are informed by the writer that a fire has been lit for fumigating purposes in his house. The ground floor of the house is used as a stable, and he complains that the fire causes danger to the house through being in proximity to the grass." I replied that there was very much more danger from the stable. Insurance Company's complaint.

216. In September, a large number of Bunniahs living in Mandvi went in procession to the sea and thus shewed themselves to be willing to do everything to appease the gods ; but at the same time they did little to cleanse the overcrowded houses or chawls. A Procession.

217. Towards the end of September and in the beginning of October a very hostile feeling had arisen. Every sanitary measure was opposed. The hostility or ill-feeling aroused by the removal of the sick to hospital was extended to all our measures. General hostility to the removal of cases to hospital.

218. The Police had constantly to be called in. Scattered as the work was throughout this great city, it was impossible for the Police to be wherever disturbances arose, although they always came quickly to the rescue of the men employed in sanitary operations.

Not one officer complained against.

219. It is gratifying that not one complaint during the period of agitation was made against any officer of the Health Department, and I believe I am right in stating, or any officer of the Police.

Sympathy between scavengers and the people.

220. Fortunately, the hostility was not directed against the men on conservancy duty; it was directed against the men removing the sick and those engaged in treating buildings. But a more dangerous feeling arose through the sympathy between the scavengers and halalkhores and the mass of the population: aversion to hospital, that is aversion to medical treatment and not to the building, aroused a common sympathy and intense feeling in the masses. That aversion was just as strong against private hospitals, for instance, had it not been for the tact of Professor Muller not a servant would have gone into the private hospital for servants.

Appointment of a Committee by Government.

221. On the 29th of September, a Committee was appointed by Government. The Committee held their first meeting on the 31st of September and resolved that the Municipal Commissioner be requested to obtain sanction from Government to carry out, as far as practicable, the sanitary measures recommended by the Surgeon-General. The second meeting was held on the 9th of October, at which it was resolved that all cases, recognized as bubonic fever, should be carefully isolated or segregated in the best manner possible. Some discussion took place, and Dr. Viegas, after voting for the motion said, that he had done so on the understanding that those cases which could be isolated or segregated in their own houses, should not be removed.

Segregation.

The Surgeon-General's letter and advice, increase of Medical Staff.

222. On the 29th of September the Surgeon-General wrote to Government as follows:—

“Firstly, then, I should suggest an immediate increase of the sanitary staff of the Municipality, both in Medical Officers who may be chosen from local practitioners willing to serve, and subordinates, with the special object of paying sanitary attention to quarters of the city not yet known to be infected. I may here mention that two cases are said to have occurred in the Fort last evening.”

All suspicious cases treated as Bubonic Plague.

223. From the very beginning, I may mention, the measures suggested by the Surgeon-General had, as far as practicable, been carried out. The system of treating buildings in which cases occurred was the same all through the epidemic. There is no other system which could have been adopted.

224. One of the first orders I issued was that every suspicious case was to be treated for all practical purposes as one of Bubonic Plague.

Notification by the Commissioner.

225. On the 6th of October, the Commissioner issued the following Notification:—“Whereas a dangerous disease, namely, Bubonic Fever, has broken out in certain parts of the City of Bombay and the Municipal Commissioner is of opinion that the ordinary provisions of the City of Bombay Municipal Act, 1888, or of any other laws in force in Bombay are insufficient for the purpose of effectually preventing the spread of such disease, Public Notice is hereby given that, with the sanction of the Government, and pursuant to the provisions of Section

434 of the said Act, the Commissioner hereby prescribes the following temporary regulations to be observed by the public and all persons concerned. And further that the Commissioner will, if necessary, take such special measures as are hereby indicated for carrying into effect the objects of the said regulations :—1. In extension of the provisions of Sections 422, 425 and 427 of the said Act, it is hereby prescribed that every person having the control or charge of any building, or part of a building shall, on demand by the Commissioner or any Officer to whom the powers, duties or functions of the Commissioner under those sections may have been or may be delegated, immediately cause such building or part of a building to be opened, and shall permit the Commissioner or any such Officer as aforesaid to cleanse and disinfect the same, to cause the removal for disinfection or destruction of any grain, bedding, or clothing, or of any other goods or articles found therein. For the purpose of carrying into effect the object aforesaid, the Commissioner or any such Officer as aforesaid will, whenever he shall deem it necessary so to do, break open and forcibly enter any such building or part of a building and, without previous notice to the owner or occupier thereof, will cleanse and disinfect the same, and direct or cause the forcible removal and disinfection or destruction of any grain, bedding, clothing, goods, or articles as aforesaid. 2. In extension of the provisions of Section 424 of the said Act, it is hereby prescribed that any person suffering from bubonic fever, wheresoever found and whether provided with proper lodging or accommodation or not or whether lodged in a building occupied by more than one family or not, shall, on a certificate signed by the Executive Health Officer or by any duly qualified medical practitioner that such person is suffering from the said disease, be liable to be removed to any hospital or place at which patients suffering from the said disease are received for medical treatment. For the purpose of carrying into effect the objects of this regulation, the Commissioner or any Officer to whom the powers, duties, or functions of the Commissioner under Section 424 have been or may be delegated, or any Police Officer empowered by the Commissioner in this behalf, will, whenever he shall deem it necessary so to do, cause any person in respect of whom such certificate as aforesaid has been made to be removed to any such hospital or place as aforesaid. 3. Every house in which any case of the aforesaid disease exists or has existed shall, for so long as the Commissioner shall deem necessary, be isolated in accordance with such orders as the Commissioner may in each case prescribe, and every occupant of such house and other person who may be therein or who may resort or desire to obtain access thereto, shall obey any order which he may receive from the Commissioner or any Municipal or Police Officer empowered by the Commissioner in that behalf, prohibiting ingress to or egress from such house. For the purpose of carrying into effect the objects of this regulation, the Commissioner or any such Municipal or Police Officer as aforesaid will, if necessary, forcibly prevent persons from entering or leaving such house.”

226. The notification of the Municipal Commissioner of the 6th of October 1896 in regard to the regulations to be observed in the treatment of buildings where cases occurred, and of persons suffering from the disease was received with loud denunciations, and answered by petitions protesting against its terms, and many classes of the population announced that they would leave the city and undoubtedly they intended to do so. It was stated that the hospitals were places <sup>Public excitement and alarm.</sup>

of torture and places intended to provide material for experiments. The Officers of the Health Department were charged with a brutal pleasure in dragging the sick from their homes and in killing them, and it was stated that our Sovereign Lady the Queen had demanded 500 livers of the people of Bombay to appease the wrath aroused at the insult offered to her statue. Men have said to me "You think we are like mad dogs, and you want to kill us, as if we were."

Panic and the panic-stricken.

227. There were men—and aged men—from whom sage counsel and words of wisdom might have been expected, but who kept calling out "lost," "lost!" and crying to us "burn," "burn." As people in a panic flying from danger unknown, so some in mad panic fled; they knew not whither. A fear seemed to have taken possession of the minds of some, when all fear ought to have disappeared; many fled from their own fears and in flying frightened others. Some who might have been expected to be calm, if they did not remain silent, kept calling to others to fly and save themselves. They wantonly called on the Health Officer to burn down districts, as if I had not chemicals to do, with not less certainty, what fire does.

Petition against segregation.

228. A petition from a number of influential citizens was sent to the Commissioner on the 14th of October. It was stated that, hospital life being unknown amongst the people, the patient himself was most averse to being removed and deprived of the care and comforts he could count on in his family, and his removal was looked on both by himself and his attendants, as certain death. In this petition it is stated that, if the regulations continued to be enforced, a much larger number of inhabitants would fly from Bombay. The petitioners demanded that the regulations should be carried out by all Municipal subordinates with care, judgment and tact; that friends and relatives did not like to part with their sick nor see them taken to hospital "recklessly"; that "house measures" should not be entrusted to young and raw European and Eurasian lads; otherwise there would be more discontent and panic, and so on.

Arthur Road Hospital regulations allowing friends to see patients. Greatest consideration shown to friends of patients.

229. It should be understood that the sick who were removed to hospital were not separated from their friends as alleged. In the Arthur Road Hospital one or two friends were always allowed to attend upon the patients, and visitors were admitted into the hospital at all hours. In one case the Medical Officer wrote that a Hindu female was admitted with ornaments of the value of a couple of hundred rupees; that the next day her relatives came to see her and took charge of the ornaments and then went away, but never afterwards returned. The woman died, and her body had to be removed by the Municipal Authorities.

Appointment of a Committee.

230. On the 15th of October, a Committee was appointed to enquire into the nature and history of the disease.

Threatening attitude of mill hands and the attack on the Arthur Road Hospital.

231. On the 20th of October, 500 mill hands assembled on the road outside the Arthur Road Hospital and threatened to wreck the building and carry off the patients. On the 29th, some 900 or 1,000 mill hands collected and rushed into the compound of the Hospital and threw stones at the building, chasing the staff into the offices and inside the hospital. Even some of the patients were struck by the missiles, and all were greatly terrified. The news of the disturbance was at once telephoned to the Police who promptly appeared on the scene. In this dis-



turbance one of the ambulance vans was smashed, and the roof of the hospital damaged.

232. The mill hands were a source of much anxiety. Yet they had been Mill hands. very considerably dealt with. Whenever a case had occurred in mill buildings occupied by mill hands, or in other buildings, so long as it was fairly isolated, it was left alone. We had also agreed that if the mill hands gave information of cases and isolated them, they would not be removed to hospital.

233. On the 30th of October, the Municipal Commissioner issued the Notification, hereafter referred to, and I think it will be generally admitted that the terms of the Notification were most reasonable and considerate.

234. The mill hands could more easily than even the halalkhores and scavengers be segregated in their own buildings, and besides the Managers of the Mills had erected huts on open ground for their workmen.

235. At this time the scavengers, the drivers of carts and the halalkhores were very restless. They spoke of leaving the city, saying that if the "setts and sahebs" left, they would also require a change of air. A little later they tried to leave the city, and we had in despair to appeal to the Agents of the Railway Companies and the Agents of Shepherd's Line of Steamers to refuse tickets to all scavengers and halalkhores. It is not necessary, even if it were wise, to dwell long over all the difficulties that beset us, but great peril had been avoided by prudence. I will only add that the men were watched without flagging by the Sirdar Abdul Ali under the instructions of the Commissioner of Police, Mr. Vincent, and that they did not baffle the skill nor evade the vigilance of the Police.

236. We had already had to seek the assistance and ask the advice of the The help of the Police. Commissioner of Police. Mr. Vincent most readily came to our assistance and instructed the Criminal Investigation Department to watch our men.

237. The position was a most grave one. On the night of the 30th of October, I was summoned to a meeting with the Commissioner of Police and the Commissioner. I had no doubt as to the occasion, for in the streets we could hear words that indicated what was passing in the minds of the people. The Commissioner of Police was of opinion that a riot would occur if the Health Department continued to enforce the removal of the sick to hospital. I had no doubt a riot would occur, and eager as I had been to remove the sick to hospital, I admitted at once that, if the policy was continued, not only would a riot occur, but that all the sanitary business of the city would stop, and that we should not have men either to segregate the sick or to clean the city, and that we should be left alone. When a riot occurred a few years ago, and when a disturbance in ordinary times arose, all sanitary work ceased. A calamity even greater and more sudden than the pestilence might have overtaken the city. The total interruption of the sanitary arrangements would have made the city uninhabitable, and the plague would have raged unchecked.

238. The Commissioner issued on the next day the Notification of the 30th October 1896. That announcement saved the city. Had it not been issued and had a riot occurred, all business would have ceased; the people, including all the scavengers, halalkhores and drivers of the Health Department, would have

surged out of the city in a panic-stricken mass, uncontrollable in their frenzy and flight, carrying pestilence to the towns and villages around Bombay. Bombay would have been ruined, and every town and village close to Bombay overtaken by the calamity. The stricken crowds of people flying from the city would have been so vast that no force could have controlled them; at the same time portions of the town might have been fired and plundered, and total ruin might have come on the city. There was another aspect of the serious problem confronting Municipal authorities and Government on which it was necessary to maintain absolute silence at the time. The dangers I have now indicated were very real, and were only prevented from developing by unsleeping vigilance and tactful prudence.

239. Had at any time matters been pushed to extremities, there would infallibly have been a general exodus of the halalkhores, scavengers, labourers, and cartmen and in the general panic the dock and mill hands would also have fled the city, putting an end to the last remnant of trade, and completing the ruin of Bombay. The plague would have been carried throughout the Presidency where there was no organisation capable of controlling the movements of the fugitives. Those who were best able to judge were satisfied that in a supreme crisis of the kind, the Police Force, loyal and enduring as it had shown itself during long months of great strain, could not have been counted upon. Their sympathies were with the suffering population of which they formed part. The following is the Notification of the Municipal Commissioner :—

“Whereas the Municipal Commissioner is informed that great alarm has been caused to the public by the Notification recently issued under Section 434 of the Municipal Act, and whereas the objects of that Notification have been misunderstood, inasmuch as the powers under it were obtained principally to meet the case of a large increase of bubonic plague. The public are now hereby informed that no cases where proper segregation and treatment can be carried out on the premises will be removed to the Arthur Road Hospital, and in such cases as require removal no action will be taken except upon the certificate of a qualified medical practitioner employed by the Health Department. The Executive Health Officer has been instructed accordingly and the Commissioner of Police informed.”

Committee  
appointed.

240. On the 11th of December, a Committee, composed of members of different communities, was formed. At a meeting held on the 22nd December, Mr. Hankin put his views before the Committee, and advocated the removal of the healthy from infected dwellings. The Committee approved of this recommendation and appointed a Sub-Committee to ask the Municipal Commissioner to form camps where the healthy could reside. Previous to this the Commissioner had constant conferences with representatives of different communities. The Committee issued the following notice :—

“HOW TO AVOID THE PLAGUE.

At a meeting of several influential citizens held on the 11th of December 1896, the gentlemen whose names are given below, representing the different communities of this city, were appointed to form a Committee to consider, amongst other things, the steps best calculated to prevent the spread of the plague and to recommend to the people at large the precautionary measures to be adopted to avoid the disease. The Committee have been able, with the assistance of the best expert opinion, to prepare the following rules which embody recommendations which should be carefully observed, and, in order that these rules may be widely known to the public

the Committee have decided to publish and circulate them in different languages in the form of hand-bills over their signatures. The Committee hope that it will be clearly understood that the instructions and recommendations contained in the following rules emanate from the Committee. The names of the members of the Committee will, it is to be hoped, be a sufficient guarantee to the different communities of this city that the recommendations made are in the best interests of the people themselves and of the health of the city. In view of the present dangerous state of public health, the necessity of keeping houses in the town, and specially those in crowded parts, clean and free from bad smells, and of following the instructions contained in the rules, cannot be too greatly impressed upon the people. Light and air ought to be allowed to enter houses freely, and wherever the means of ventilation are not sufficient it is extremely desirable that steps should be taken to provide better ventilation, so that sunlight and fresh air may enter the rooms. The Committee earnestly hope that the advice given by them, coming as it does from the representative men of the different communities, will be cheerfully accepted and acted upon.

In the rules the Committee gave excellent advice. They urged the people to inform the Municipality of all cases, and to leave infected houses. The danger of wet or damp places inside dwellings was pointed out. They advised the people to be careful of abrasions or sores. They dwelt on the necessity of burning all articles that had come in contact with the sick.

DR. BHALCHANDRA KRISHNA BHATAVADEKAR.	} <i>Honorary Secretaries."</i>
MR. K. N. KABRAJI.	
DR. ISMAEL JAN MAHOMED.	
PROFESSOR O. V. MULLER.	
DR. A. D. MODY.	
DR. N. N. KATRAK.	

#### COMMITTEE.

##### EUROPEANS.

Sir George Cotton.  
Dr. Thomas Blaney.  
Professor O. V. Muller.  
Mr. D. Gostling.  
„ C. Vernon.  
Voty.-Major J. Mills.  
Mr. H. G. Gell.

##### PARSEES.

Sir Jamsatjee Jijibhai, Bart.  
Sir Dinsha M. Petit, Bart.  
Sir Jehangir Cowasji Jehangir.  
The Hon'ble N. N. Wadia.  
Mr. K. R. Kama.  
„ K. N. Kabraji.  
„ N. J. Gamadia.  
„ B. D. Petit.  
„ Jijibhai F. Petit.  
„ Rustomji N. B. Jijibhai.  
„ Jijibhai M. Jijibhai.  
Ervad Jivanji Jamshedji Modi.  
Mr. Darasha R. Chichgar.

Mr. Nusserwanji B. Jusavala.

„ Pestonji N. Wadia.  
„ Khursedji Nusserwanji Wadia.  
Dr. K. N. Bahadurji.  
„ B. S. Shroff.  
„ F. N. Bisni.  
„ A. D. Modi.  
„ N. N. Katrak.

##### MAHOMEDANS.

The Hon'ble Mr. Justice Badrudin Tyobji.  
„ „ „ A. M. Dharamsi.  
„ „ „ Fazulbhai Visram.  
Kaji Mahomed Ali Morgay.  
Mr. Najmudin Tyobji.  
„ Adaraji Peerbhai.  
„ Shaik Adam Yousufbhin.  
„ Currimbhai Ebrahim.  
„ Mukhi Ladek Haji.  
„ Abudlabhim Lalji.  
„ Suloman Abdul Wahed.  
Haji Mohomed Haji Ismal.  
Haji Sabood Sidik.  
Haji Hasum Noorani.

MAHOMEDANS—*contd.*

Dr. Ismael Jan Mahomed.  
 Mr. Oomer Jamal.  
 Haji Cassum Metha.  
 Mr. Badrudin Abdulla Kur.  
 „ Mahomed Ismail Makba.  
 „ Dawoodbhai Moosabhai Sheraji.  
 Aga Abdul Hoosein.  
 Haji Kasim Joosuf.  
 Mr. Nur Ali Chowdri.  
 „ Mahomed Hasan.  
 „ Fakir Mahomed Baban.  
 „ Ramzan Khan Baban Khan.  
 „ Abdulla (King).  
 „ Makanda Mabarak.  
 „ Heraj Kaloo.  
 „ Sajan Fakeera.  
 „ Mahomed Ismal Makba.  
 Sayed Ibrahim.

## HINDOOS.

Dr. Bhalchandra Krishna.  
 Mr. M. G. Chandravarkar.  
 „ Chaturbhuj Morarji.  
 „ Gokaldas Madhhavji.  
 „ Jambadas Naranji Khatau.  
 Dewan Bahadoor Manibhai Jasbhai.  
 Mr. Mansukhram S. Trepathy.  
 „ Panachand A. Parekh.  
 „ Moolraj P. Parekh.  
 „ Govindji Tharkersey Moolji.  
 „ Ruttansi Moolji.  
 „ Dharamsi Sunderdas.  
 „ Gelabhai Haridas.  
 „ Damodar Gordhandas.

Mr. Lakhmidas Khimji.  
 „ Vijbhukandas Atmaram.  
 „ Raoji V. J. Sunkerset.  
 „ Tribhovandas Mangaldas.  
 „ Tribhovandas Varjivandas.  
 „ Dwarkadas Shamji.  
 „ Harkisondas Narotumdas.  
 „ Ramdas Keshowji.  
 „ Venkoo Baloo.  
 „ Jaya Karadi Lingu.  
 Rao Saheb Elapa Balaram.  
 Mr. Nagoo Sayaji.  
 „ Karamsi Damji.  
 „ Kushaba Kale.  
 „ Dhondi Hanmantrao Barde.  
 Rao Bahadur Narayen Megaji Lokhande.  
 Mr. V. K. Wandekar.  
 „ Ghamaji Balaji Rukare.  
 „ Ragunath Balaji Malap.  
 „ Dhondi Meher.  
 „ Tukaram Hunde.  
 „ Wagu Hanumati Babde.  
 „ Bhau Dhumale.  
 „ Sitaram Komar.  
 „ Balkrishna Bhevaji Nakwa.  
 „ Janardhan Hiraji Patel.  
 „ Tukaram Jaji Dadaji.  
 „ Balkrishna Narayen Pevekar.  
 „ Vithoba Patel.  
 The Hon. Daji Abaji Khare.  
 Dr. M. G. Deshmuk.  
 „ G. B. Kher.  
 „ S. V. Kane.  
 Mr. Baskerao Balkrishna.  
 „ Harichandra Pandurang.  
 Rao Bahadur Vishnu Bapat.

Erection of camps  
by the Municipal  
Commissioner.

241. The Committee pledged themselves to use their influence to reconcile the people to the use of the segregation camps, but it was not possible to persuade the people and especially the poor at this time to enter either camps or hospitals.

The Commissioner put up excellent camps underneath bright-colored awnings, capable of accommodating some 1,500 people, one was erected in the Northbrook Gardens, and the other near Connaught Road, but people would not enter them although they were most attractive.

Notification issued  
by the Commission-  
er.

242. On the 4th of December the Commissioner issued a notification calling the attention of medical men to Section 421 of the Municipal Act.

Views of the masses.

243. From the beginning the mass of the inhabitants held views which are vividly, if quaintly, expressed in a petition addressed to the Municipal Commissioner on the 13th of October.

244. To show how, even as late as the 31st of March, intelligent people (Eurasians) regarded our measures, the following letter addressed to the Municipality from a High School is interesting :—

“ I am sorry at troubling you with my complaint, but I wish to have a stop put to all the inconveniences myself and other families are undergoing owing to the sickness of my son, who unfortunately received an injury and caught a severe chill which brought on fever. I have taken every precaution by doctors, &c. I have had four doctors in attendance and my son had no symptoms of plague whatever whilst ill, but his temperature rising to 103 degrees, I thought it advisable to remove him to the European General Hospital as there were a number of people living near also. My son was put into the No. 2 Ward ; after Dr. Arnott had examined him, he was convinced it was not the plague. For two days my son was in No. 2 Ward and then removed to the Observation Ward for three days. After that I believe symptoms of the plague appeared, and then he was removed to the Plague Ward. So now, Sir, the Municipal authorities have come and put me to great inconvenience and fumigated my place and wanted me to leave at a moment's notice. Where am I to go, could you kindly inform me, as there is no place provided for me and my daughter. I cannot be turned out on the streets at a moment's notice, and I am a widow also, and have no one to come and render me any assistance in this case of emergency. So please send an order and stop their annoying me any further—for which I shall feel very grateful—or provide some place of habitation. Hoping you will pardon the trouble.”

245. One who was much alarmed wrote :—“ Owing to the critical condition in which we are at present placed regarding the bubonic plague, I think I am justified in placing before you the fact, that yesterday, at short intervals between each, five corpses passed the abovementioned locality—presumably of the Hindoos. These corpses were taken as usual on wooden biers, but in a very quiet and suspicious way. They were bandaged from head to foot with rags and dirty clothes in such a manner that nothing could be seen of the dead body, and without chanting their usual songs, &c., when the dead bodies are taken away for cremation. I am afraid the suspicious way in which the corpses were carried has got something to do with the secreting away of the plague-stricken natives, and therefore it is worth while to have enquiries made into the matter.”

246. On the 17th December, the *Bombay Gazette* took a hopeful and manly view of the position and wrote :—“ As there has been a marked fall, there seems reasonable ground for hoping that the mortality may continue to diminish as the temperature falls. Were the worst to come, and the death-rate to rise anything approaching the appalling figures that have made ‘ plague ’ a word of terror throughout the East, it would then be necessary to see whether a great Camp of Refuge to the north of the city might not become a necessity of the time.”

247. In January the Commissioner of Police had issued a circular directing that any persons ill from bubonic plague, detected while removing from one building to another, should be summarily removed to hospital.

sense of duty to the sick and aversion to hospitals.

248. The following extract from a petition received about the time is at once suggestive and pathetic:—“There is, moreover, such a high sense of duty among the native population in the matter of attending to their sick, having their sick under their own care, and performing their last rites in case of their deaths, that a total removal of the patients from their midst, under circumstances which entirely preclude a further meeting, and for the matter of that all further information of the patients, is inconceivable by them, and is absolutely shocking to their feelings; hospital life being entirely unknown, as it is among the natives, the patient himself is most averse to being removed and being deprived of the care and comforts he can count upon in his family, and his removal is looked upon by them and by himself, and his attendants as sure death.”

249. All the Police Officers gave great assistance to the Municipal authorities. Mr. Vincent, the Commissioner, and Mr. Gell, the Deputy Commissioner, were constantly in the districts, saw the work, realised the difficulties of the Municipal Officers, and assisted in every way by their advice and sympathy. I have referred to the services rendered by Sirdar Abdul Ali. The Sirdar worked hard to assist us and gave us the fullest information, and his information and advice were of great value.

Anxious weeks.

250. For many anxious weeks we could not tell from day to day whether the morrow might not see us without men to meet the pressing sanitary needs of the city. For months a time of great anxiety passed, which was known to few except the Municipal Commissioner and the Commissioner of Police.

Quacks.

251. Many good men were spoiled by aspiring to the honours of being Plague Doctors. Mallees and Mahars, and even men employed in the service of the Tramway Company and in the service of the city, persuaded themselves and encouraged others to believe that they had a cure for plague.

Plague Doctors.

252. Once a man became a Plague Doctor, he was seldom happy or contented in any regular work. If he did not save his followers, he ruined himself for honest toil. One enthusiast became an amateur Doctor, and persuaded himself that the disease was not infectious, and he preached his convictions to his neighbours. He opened a dispensary in his own house with lamentable results to his family and himself, for he caught the plague and died and several of his family fell victims also to the disease.

A sad case of a Doctor.

253. A sad case of a far different character, illustrates the excitement of the time. A young medical man, just passed out of College, entertained a strong conviction that the disease was not infectious. He opened an hospital, at a little distance from Bombay, and four patients were placed there under his treatment. So strong was the conviction of this medical man that the disease could not be communicated from person to person, that he slept in the ward with the patients. The result of the experiment was as sad as it was certain, for he died even before one of the four patients under his care in the hospital encumbered.

254. It was interesting and often pitiful to observe the whims that Whims of people. took possession of men and women during the crisis. People who thought that the poor who slept on damp ground with a thin sheet underneath them and who kept their little strength on a wage of from 4 to 6 annas a day ought to be happy because they had been born to it, almost wept when they saw one of the same poor, ill from Bubonic Plague, lifted into a Municipal ambulance drawn by a good horse. There was no real compassion and no true pity in this view.

255. The impression that human beings can be forewarned by animals of Animals foretelling disease. the coming of disease is very widespread. In a book written some years ago by Mr. Curzon during the prevalence of the pestilence in Constantinople, I read an incident illustrating this curious belief. "I had at this time a lodging in a house Curious belief in dogs foretelling sickness. at Pera, which I occupied when anything brought me to Constantinople from Therapia. On one occasion I was sitting with a gentleman whose filial piety did him much honour, for he had attended his father through the horrors of this illness, and he had died of the plague in his arms, when we heard the dogs baying in an unusual way. On looking out of the window there they were all of a row, seated against the opposite wall, howling mournfully and looking up at the houses in the moonlight. One dog looked very hard at me. I thought I did not like it at all, and began to investigate whether I had not some pain or other about me; and this comfortable feeling was not diminished when my friend's Arab servant came into the room and said that another person who lodged in the house was very unwell; it was said that he had had a fall from his horse that morning. The dogs, though we escaped the plague ourselves, were right; the plague had got into one of the houses close to us in the same street; but how many died of it, I did not learn."

256. On the 30th of September 1896 I wrote to the Commissioner in refer- First measures. ence to Bubonic Plague. I informed him that the measures described in that letter, and which he had seen during inspections made at all hours, were being vigorously carried out. All cases of fever even then were treated as cases of suspected plague and the buildings disinfected. "All cases of fever are treated as suspected," I wrote. "Long before this crisis arose, you have discussed with me the abnormal and serious conditions that would arise should the monsoon hold off. In the various districts of B Ward—Mandvi, Nowrojee Hill, Chukla and the Port Trust Estate between Frere Road and the G. I. P. Railway, where cases have been reported, vigorous cleansing operations and other measures of a rigorous character have been in full force; gullies are being flushed and disinfected and the outside and portions of the inside of buildings are being flushed; disinfection of the rooms and houses generally is being carried out. Lime-washing of the rooms in which cases have occurred is being carried out at once in all buildings, and everything possible is being done to speedily remove all insanitary conditions especially near buildings. In Khetwadi, where cases have occurred, and in Walkeshwar Temple compound, to which persons from the affected district not suffering from fever have gone, the same measures have been adopted, but in the latter locality no real flushing is possible Absence of drains; difficulties. on account of the absence of drains and water-supply, and disinfection had to be effected under great difficulties. The same procedure has been adopted in any

house in any part of the city where a suspicious case of fever has occurred. I have engaged up to the present the following extra establishment :—

Carts ... ..	120
Bigaries ( extra men and women) whom I have had great difficulty in finding ... ..	50

In B Ward, where the disease has been prevalent, assistance has been given to the staff by transferring men from other sections. I have obtained your sanction to employ the following extra establishment :—

	WARDS.				PER MONTH.
	A	C	D	E	
					Rs.
Sub-Inspectors at Rs. 30 each ... ..	1	1	1	1	120
Halalkhore Mucadams at Rs. 15 each ... ..	1	1	1	1	60
Scavengers at Rs. 9 each ... ..	30	30	30	30	1,080
Halalkhores at Rs. 11-8 each ... ..	20	10	10	10	575
Bullocks with carts (hire per day per pair with a driver, Re. 1-6) ... ..	20	20	20	20	3,300
Total ... ..					Rs. 5,135

First measures.

I have been using disinfectants on a very large scale and have indented on the Contractor for further large supplies, as the stock in the Municipal Store is nearly used up. Details of this will be submitted hereafter. We have had in use three Fire Brigade engines flushing houses and gullies—one in Mandvi, one in Khetwadi, and one in the Fort. The Health Department steam flushing and hand engines have been at work and also a flushing reel. I have employed three special medical men for duty in Mandvi and asked the co-operation of others, and I have written to the hospital authorities asking them to assist us in obtaining the services of five more medical men on a salary of Rs. 250 each per mensem for the treatment of cases and for general duty. The Port Trust authorities are giving us valuable assistance in the flushing of drains, and the inspection and disinfection of godowns. In my opinion all grain ought to be taken out and exposed to the sun, and loose grain lying on the floors burned and the godowns disinfected. The Drainage Department has been actively at work for a long time in opening up the old drains on the Port Trust Estate and in other parts of the City and removing the deposit therefrom. Upwards of 200 men are now employed on this work. Special arrangements have been made by the Drainage Department for the flushing of these drains day and night, and enormous quantities of disinfectants have been poured into them. I have sent you to-day a separate reference in regard to the action which I thought specially necessary in regard to the cleansing and disinfection of the down-take pipes of houses in which cases had occurred. Acting under my advice, the Drainage Department has been removing these pipes, most of which are either cracked or broken, from the houses, subjecting them to a special cleansing and other treatment, and afterwards either re-



erecting them or putting up new ones when they were cracked and broken, as most of them have been. It seems to me that, if any real attempt is to be made in regard to house sanitation, this is the only procedure possible, as any other course would mean months of delay, and the pipes after all would not be renewed nor thoroughly cleaned. The Assistant Health Officer and I have been giving the greatest attention to the carrying out of the above sanitary precautions, and the ward staff are all working over-hours energetically and cheerfully. I have promised that all men who work over-hours, or who work specially well, will receive extra pay. I have to request your sanction to this, so that, as on some other occasions, difficulties will not be raised and fruitless correspondence ensue. At a time of this kind, when work is urgent and of an arduous nature, we must be generous to our men. If they did not work as they now do, it would be absolutely impossible to carry out the precautions we are now taking. We have, I may mention, the greatest difficulty in obtaining extra men. The men of the Drainage Department, I venture to submit, should be treated in exactly the same way as they have been working cordially with us, and there was, I believe, the same difficulty in obtaining men for the drainage work. The total number of deaths reported up to day amount to 74. I have destroyed large quantities of grain which was found either to be dirty or damaged or collected from sources which may have been affected. It may be necessary to destroy larger quantities still. All bedding and all clothing worn or used by the sick we also burnt. There is, however, a serious practical difficulty experienced in disinfecting the bedding of the many occupants, relatives and others living in the houses in which cases have occurred. To disinfect the whole of this is practically impossible, and it will be necessary to burn a large quantity. We have found, in the course of inspection, the greatest necessity for the interior cleansing of houses. The houseowners are utterly indifferent to the necessity of cleansing the interior of their properties, and the tenants absolutely refuse to do so, as they say the landlords should do it. We have had to take Municipal men inside houses to clean out the rooms and passages—a work which it is the duty of the landlord or tenant to perform. If cleansing of the interior of houses is to be carried out, it will be necessary for the Health Department to adopt the extreme measure of taking men inside the houses and forcibly cleaning them. The amount of rubbish, of rags, and old clothes I have seen inside the rooms is incredible. The measures now being taken are merely palliative, and I would briefly indicate the measures, all of which you have frequently discussed with me long before this crisis arose, necessary against the development and spread of this and other disease of an epidemic type :—

- (i) The commencement at once of all the drainage works, both on the surface and underneath, necessary to complete the drainage of the Island. I need not refer to all my former reports for years past, urging that the drainage of the Island should not be trifled with.
- (ii) The immediate amendment of the Municipal Act in respect of the various sections already reported upon and particularly in regard to the ventilation of houses and provision of gullies and the invalidity of the evidence of Municipal Officers in Section 372 (cl. f.), 377, 384 (6) and 397.

- (iii) The immediate conversion of all the open side-drains, ditches and gullies throughout the Island into open drains provided with flushing tanks.
- (iv) The removal and re-erection by the Municipality of all the down-take pipes of houses that are in bad order.
- (v) An immediate decision as to whether the Health Department is to continue the cleaning of private properties. If this is to be continued, the department must be increased by 20 per cent.
- (vi) An immediate decision as to the disposal of all the refuse of the City—this long pending question which I have described as a public danger.
- (vii) The adoption at once of a complete system of medical and charitable relief and the erection of buildings for the poorer classes in each ward.

I have referred to this in my letter No. 2194 of 21st of April 1896 to the Municipal Commissioner, which was placed before the Corporation on the 25th of June 1896."

257. On the 5th of October I reported to the Commissioner as follows :—  
 "In continuation of this office No. 22005, dated the 30th of September 1896, I have the honour to report as follows :—From 10 a.m., 4th instant, to 10 a.m., the 5th instant, there has been only one case of Bubonic Fever on Mandvi Bunder. In my opinion the disease has, for the time, been stamped out from the Mandvi Bunder. The real crisis has not yet come. It will come during the next few weeks should there be famine or severe scarcity. Already, I believe, immigrants from the areas in which the crops are scanty or sickly have commenced to move towards the city, and small numbers have arrived. Should severe scarcity fall on the districts of this Presidency, we may expect a recrudescence not only of this form of fever, but of other malignant epidemic types of disease. We cannot forget the experience of 1877, when from the 15th of August to the 30th of September 36,258 people staggered into the city over the Coorla Causeway. You have discussed with me the measures that should be taken to intercept, in the event of famine or severe scarcity, famished immigrants, and to remove others from the city to a camp to be constructed near Coorla without Municipal limits. The total additional establishment now at work is as follows :—

Mandvi.

	WARDS.					Total.
	A.	B.	C.	D.	E.	
Medical Officers ... ..	1	2	4	1	2	10
Sub-Inspectors ... ..	...	...	1	...	...	1
Mukadams ... ..	...	...	...	...	1	1
Halalkhore mucadams ... ..	1	2	1	...	1	5
Do. men ... ..	10	10	10	10	10	50
Bigarees men ... ..	16	46	16	16	16	110
Do. women ... ..	8	18	8	8	8	50
Carts ... ..	20	20	28	26	26	120

At present we are able to cope promptly and thoroughly with any cases of this or any other disease. But should there be famine, this department will have

to be enormously increased—in scavengers and halalkhores. We have had the greatest difficulty in obtaining the additional number of men we have employed and who are now at work and, if more men have to be employed, we shall have to bring them from up-country and employ agents to obtain them. In the table following is shown the number of cases and the mortality from the specific type of fever that has been prevalent in Mandvi. It will be observed that the percentage of deaths to cases is equal to 68·6 per cent.:—Whatever the future may be, whether the calamity of famine and scarcity, or more prosperous times, not a single precaution now taken, not a single measure now adopted, can be relaxed or abandoned. We know too well the disastrous result of paltry economy.” To facilitate work and strengthen our organisation, offices were put up on the foot-paths in each section of the city. These offices were the centres of work in each district; disinfectants and apparatus were kept in them. At two of the offices dispensaries were opened and placed in charge of the medical officers of the districts.

258. The precautions I advised to be taken may be seen from the following leaflet which I had printed and circulated in October in three different languages :—“ A disease of a peculiar nature characterised by fever and swelling of the glands is prevalent in Bombay. This fever is propagated and increased by living in an insanitary way, especially in overcrowded and dark buildings, by taking an insufficiency of proper food and hence lowering the vital power, and by neglecting wounds or abrasions on the surface of the skin. In order to check this fever, it is necessary that the people should co-operate with the Municipal authorities by reporting at once to the Health Officer or the Ward Medical Officer every case of fever with swelling of the glands. This is necessary in order that the sufferer may be promptly treated and that precautions may be taken to prevent the spread of the disease and the infection of others. It is observed that the people who are most often attacked are those who live in dirty, overcrowded buildings, insufficiently lighted and ventilated, and who do not eat good food. The Municipal authorities are prepared to clean and disinfect all houses in which this disease has appeared, and people will best help by not putting any obstruction in the way of Municipal officer. Further, all people are warned that the best way of avoiding this fever is to clean and keep clean and admit light to every part of their habitations, keep all doors and windows open, burn all old rags and rubbish that may have accumulated, eat a sufficiency of good food including fruit, and carefully cleanse and cover all wounds or abrasions of the skin from dirt and the air.”

259. One of the greatest difficulties at this stage was the want of accurate information as to the causes of death. During the epidemic the people lost all confidence in medical treatment. Of those who died, not two per cent. were seen or treated by medical men.

260. On the 2nd October I sent the following circular to all medical men :—“ I have the honour to request that you will at your earliest convenience furnish me with a list of the cases (name, age, caste and residence) of Bubonic Plague, which have come under your personal knowledge, and in all cases of death to send me the necessary certificate as required by Section 450 (1) of the Municipal

Act. This information is required to enable me to check and verify the reports already obtained by this department. I also request that you will be good enough to supply me in writing, as required by Section 421 of the Municipal Act, with information of each case of Bubonic Plague that comes under your notice."

261. One of the first measures adopted on the detection of a suspicious type of fever in the last weeks of August in Mandvi was the completion of arrangements to have the sewers flushed and the silt removed.

Mandvi Section.

262. The Mandvi Section, where Bubonic Plague first became epidemic, has a population of 37,295, distributed in 1,615 houses. It extends along the harbour foreshore on one side and on the other across some of the most densely populated streets in the city. On the east are the great granaries of the Port Trust built around open spaces, and on the west the ill-ventilated dwellings—many of them with granaries and stores on the ground floor. Most of the drainage flows through the old worn drains constructed many years ago. The drains are in bad order and badly ventilated. The scraping and cleansing necessary to keep them free from obstruction and open have injured their walls, and they leak—polluting the ground on either side.

The Sewers of Mandvi.

263. The sewers on the Port Trust Estate carry storm-water as well as sewage, and formerly discharged into the harbour. They were badly ventilated and caused great anxiety. In the drains silt had increased, and this no doubt was partly due to the distribution of the rainfall. It was difficult to remove the deposit. Grants had been obtained for special manholes, and they had been constructed in the Frere Road, but not in the cross streets.

264. In the report of 1896 the drainage of this section is condemned. I wrote :—"I have so often described the imperfect sanitary state of Mandvi that I need not now do more than refer to the description of the district in the last Annual Report. There is a large sewer, giving most insanitary communications, running through the East of Mandvi—a sewer which, from its high level, is difficult to flush except at high tide, and very imperfectly ventilated. The sewer I refer to is the Frere Road sewer."

Sewers—cleaning of.

265. The first measures of disinfection were directed to the flushing and cleansing of sewers in the locality where the disease was about to be epidemic. When I originally wrote to the Drainage Engineer on the 7th of September 1896, asking him to flush out the sewers on the Port Trust, he naturally replied :—"That it is impossible to estimate the cost of our carting grant if we are continually asked to undertake unexpected work such as this. 2. At present I have no funds to do it, and the question of enhancing the grant has not been settled." It could not have been anticipated that the monsoon current would stop as it did. Had the monsoon not ceased before the normal period, much of the removal of road detritus from the sewers of Mandvi would have been unnecessary.

Silt.

266. Most of the silt taken out was road-metal washed by the gully drains into the sewers; it was quite clean. To clean the sewers it was necessary to make openings at intervals of every 50 feet and through these openings the silt was lifted. It is to be remembered that these sewers were intended for storm-

water only, but buildings were erected and, as there were no sewers for sewage, the buildings were allowed to be connected with these drains. Large quantities of disinfectants were pumped into the sewers and drains on the Mandvi Bunder.

267. As the disinfection of the infected houses—the houses in which cases had been found—would be incomplete without removing and disinfecting the down-take pipes from each room to the open gullies, the down-take pipes of the infected houses in Mandvi were taken down, thoroughly cleaned, washed with boiling water in the street, then scraped on the inside, and afterwards placed in a bath of phenyle. New pipes were fixed on the buildings in place of old ones when the latter were in bad order. The owners had the option of removing the old pipes from the street after they had been disinfected. Removal of down-take pipes.

268. This was a large and important sanitary work, and it was, as the Commissioner knows, from the many visits he paid to the locality, and the many times he inspected buildings in which cases of Plague were suffering, admirably done. These efforts appeared to have been followed by a decrease in the number of cases from the 1st October to the 15th of that month.

269. In September people had commenced to take alarm, and measures for the closing of warehouses and the removal of people from infected buildings had suggested to them safety in flight. From the first the people were informed that the danger was from the sick and from the places where the sick were. Closing of warehouses and removal of people from infected buildings.

270. All that was necessary, so far as money could deal with the disease, was given to me from the beginning. But money will not provide at once an establishment—even an untrained establishment—large enough to meet so grave a crisis. More than double the ordinary establishment was required at once. This consideration is forgotten in judging our measures. To be ready for so great and sudden a crisis an expenditure far above the needs of ordinary years—even years when epidemic diseases are prevalent—must be incurred. It took time to obtain an increased establishment, or even the additional number of pumps required for disinfectants. We had ready portable fire-engines and flushing pumps, and they were of great use. It was most fortunate that this department had been preparing for years for a crisis, although not for so grave a calamity as the Plague. It took weeks before we could obtain the full number of flushing pumps needed in many different localities. The crisis.

271. The measures for cleansing the inside and the outside of buildings and for the improvement of ventilation were modified according to the class of population and building. The measures taken were a concentration of sanitary measures that in a less drastic manner are being daily employed. Tendency and modification of measures.

272. From the beginning the greatest attention was paid to the disinfection of houses and to the segregation of the poor. I believed from the first that the room where the patient lay was the place from which the disease might spread. There were, therefore, two principles kept in view—the treatment or disinfection of the rooms of the building and the isolation of the patient. We never had to adopt the system carried out in Hongkong of walling round an infected area.

Measures in Building.

273. The measures adopted for the treatment of buildings is shown in the abstract of directions which was printed and circulated by me. The aim was, first, the destruction of the microbes; secondly, the destruction of all that might nourish the microbes. Hence, the measures were directed to the disinfection (1) of the place in which a case had occurred, (2) of all pipes connected with that place, and (3) the immediate neighbourhood. We treated houses practically as if they were on fire, discharging into them, from steam-engines and flushing pumps, quantities of water charged with disinfectants.

Method of treatment of buildings.

274. Believing that the disease might be communicated through excretions from the sufferer, we treated first the down-take pipes or channels from the place where the sufferer was, and then the privies. There was no departure from these principles in the treatment of buildings. The essential portion of the treatment, the thorough flushing with disinfectants of all places infected, was resolutely carried out.

Crowded house and animals.

275. Crowded houses in which goats and sheep are kept were thoroughly flushed with streams of cresol or permanganate of potash to which often a little acid had been added, and the disinfectants were discharged with force from steam-engines or fire pumps—a very necessary method to leave the buildings wholesome and sweet. All refuse was removed from the infected houses and burnt, and, when possible, it was burnt outside the house from which it had been collected.

*Abstract of Directions for the Treatment of Buildings in which Cases of Bubonic Fever occur.*

Directions for the Health Department.

I. Wash with cresol or phenyle solution, using a hand-pump, or solution of quicklime, as quickly as practicable, the room in which a case has occurred or in which there may be a case suffering, and disinfect the *morees* with carbolic acid solution not weaker than 1 in 20, or a solution of perchloride of mercury not weaker than 1 in 1,000.

II. Disinfect, with the same solution, all the *morees* and all the traps of the house, giving special attention to the cleansing and scraping of places, such as the stairs, likely to retain dirt and infection.

III. In parts of buildings where insects are likely to be harboured, kerosine oil is to be used from a syringe or boiling water poured over the places.

IV. Sprinkle chloride of lime on the floors and passages.

V. Send for the flushing engine and establishment to flush and thoroughly cleanse the gullies and the outside and inside of the building.

VI. All articles likely to have been infected and of little value should be burnt. The others should be classified into three groups according to their nature—one, to be disinfected by boiling for at least an hour in water; the other, which cannot be boiled owing to the size of the articles or to the likelihood of their being spoilt by boiling, to be disinfected by pouring over them a 5 per cent. solution of carbolic acid, which ought to be allowed to dry upon them; lastly, articles which cannot, for obvious reasons, be disinfected or placed in boiling water, to be exposed to the sun for at least a day.

VII. Take the tiles off the roof so as to admit air and light.

VIII. As a measure of precaution, sprinkle carbolic acid powder or dry chloride of lime inside buildings adjoining the affected building.

IX. Whenever cases of bubonic fever are anticipated in a locality, dry chloride of lime or dry quicklime or carbolic acid powder, whichever is the most convenient, should be distributed at once house by house, and the people should be asked and persuaded to sprinkle the substance on the floors, in *moores*, and wherever there is any damp.

X. For dead rats found, a reward will be given. The rats are to be covered with a little straw, and a little kerosine oil poured over the whole and set on fire.

XI. In the use of perchloride of mercury, its properties should be remembered when coming in contact with organic matter.

*Instructions for the Medical Officers.*

XII. The Medical Officers are requested to give special attention to the destruction of all articles of clothing, &c., which have come in contact with persons suffering from bubonic fever, and the thorough disinfection in carbolic acid or perchloride of mercury or boiling water of all other articles which cannot be destroyed.

XIII. The Medical Officers shall see to the thorough disinfection and lime-washing with quicklime of every room or other place where a person has suffered from bubonic fever, and, as far as practicable, all the rest of the house.

XIV. When the Medical Officer observes that water pipes inside a building occupied by the poor classes are so placed as necessarily to cause or give rise to dampness, he shall make a special report of the fact.

XV. The Ward Inspector shall communicate at once information of any case of bubonic fever, or fevers of a suspicious type, to the Medical Officer or Officers attached to his ward. He will arrange to meet them daily, and any orders the Medical Officers give are to be promptly obeyed, and the utmost assistance given to them by the Inspectors.

XVI. The Medical Officers on their part, by inspection and enquiry, shall do their utmost to obtain information of cases, &c.

XVII. Whenever the Medical Officer of a ward is satisfied that the isolation or proper treatment of a patient suffering from bubonic fever is not practicable in the house where the patient is, the Medical Officer is forthwith to call on the Ward Inspector to make arrangements for the removal of the patient to the hospital appointed for that purpose at Arthur Road.

XVIII. Whenever a patient is to be removed to the hospital at Arthur Road, a certificate is first to be obtained by the Inspector from the Medical

Officer of the ward that the patient is suffering from bubonic fever, and that he has ordered such removal. All such certificates are to be written in the Field Book of the Inspector.

XIX. The following procedure shall be followed in regard to godowns and shops in buildings in which cases of bubonic fever have appeared :—

XX. No goods must be sold or made use of before they have been exposed to the sun for at least one day. The godowns and shops from which goods, after the above precaution, have been allowed to be removed, shall not be made use of until they have been disinfected with sulphur fumes for a period of at least three days, all doors and windows being closed and afterwards thoroughly lime-washed with quicklime. After that, provided no fresh case has occurred in the building, the godown may be handed over to the owner.

XXI. When articles which, in the opinion of the Medical Officer, may have been exposed to infection, or are likely to carry infection in them, are found in a shop or a godown, and when such articles do not permit of a thorough exposure to the sun's rays, a list of such articles is to be submitted to the Health Officer for decision as to the manner of disinfection or disposal.

XXII. Chloride of lime is to be sprinkled freely in both godowns and shops.

XXIII. The Ward Inspectors are requested to see that all disinfectants are kept covered and well protected, and that they are not kept close to each other or mixed in any way.

Opinions of Sanitary Authorities in India.

346. Sanitary authorities came here from all parts of India, and they all advised us to proceed as we were doing. The method pursued by the Municipality in the treatment of buildings has been approved by all the authorities who visited Bombay during the Plague from all parts of the world.

Opinion of the Sanitary Commissioner.

347. The Sanitary Commissioner wrote to the Municipal Commissioner :—

“ I have the honour to report, for your information, that I have been inspecting the houses in which cases of fever with buboes have occurred. I have also visited the Infectious Diseases Hospital and inspected the grain godowns on the Port Trust Estate and the one in the Docks. In the houses affected with the fever, disinfection is being carried on with great energy.”

Removal of healthy people from buildings.

Even so late as May, a large number of people who had been removed from buildings and had not been allowed to return to them, were still living under mat awnings.

For instance, in one little group of buildings in a suburb, Middle Coloba, there were as many as 1,172 people living under awnings or in the open air, as late as the last week of May.

Drastic measures of the Health Department

The drastic measures taken by the Health Department in this locality may best be seen in a tabular statement.



*Victoria Bunder Village.*

Number of people evicted from condemned houses now without shelter.	} 1,172 persons & 236 families.
Number of houses in village ... ..	44
Number of houses from which inhabitants have been evicted ... ..	41
Number of houses in which plague cases have occurred ... ..	14
Total Number of cases of plague which have occurred in village ... ..	28

[Note.—Of these only 9 cases occurred in 1897.]

First case occurred ... ..	...6th October 1896
Last case occurred ... ..	...2nd March 1897.

278. The disinfection of earthen floors caused us a good deal of anxiety. Disinfection of earthen floors. Earthen floors were dug up and thoroughly mixed with disinfectants. Various methods for the disinfection of earthen floors were suggested—one was to spread over them a thin layer of gunpowder and explode it, another was to pour over the floor kerosine oil and set it on fire, and another was to spread straw over the ground and set it on fire; the latter method was tried in several cases, but it nearly caused a conflagration.

279. In October I suggested to the Secretary of the Millowners' Association that the Manager of every Mill should be requested to disinfect the rooms occupied by Mill-hands, but in such a way as not to alarm them. Circular to Managers of Mills.

280. Early in the year we called on the Managers of Hotels and Places of Refreshment to disinfect and line-wash the cook rooms. Disinfection of places of refreshment.

281. In the beginning the attention of Managers of Grave-yards was drawn to the necessity of digging graves deep and placing quicklime or charcoal at the bottom. Grave-yards.

282. Professor Hankin gave me in October cultures of the Virus Danyasz for the destruction of rats, and I tried them but not with success. A microbe to kill rats.

283. Very early in October systematic flushing and disinfection of the gullies, courtyards, drains and portions of houses in the Fort District, where the disease had not appeared, was commenced and supervised, at my request, by the Water Engineer, and, after it had been finished in this district, the Market Section was treated in the same way. Disinfection of whole districts.

284. The Fort contains a population of 36,793, concentrated in 1,664 houses, and the Market Section contains a population of 44,751 people living in 1,724 houses; notwithstanding the measures adopted the disease passed into and across these sections. Mr. Newton who had been doing admirable work in flushing sewers was relieved of the work at the end of October.

285. The pressure of work even in October was telling, for on the 22nd, Mr. James, Drainage Engineer, wrote to me, in reply to a request, that each Department of the Municipality should be asked to assist in the afternoon in sanitary work: "As many men as can possibly be spared are at present on special duty in connection with bubonic plague, and I cannot possibly take any more men from the regular staff." And further, in November, he wrote: "It would be exceedingly inconvenient to put any men on the duty referred to."

286. In the last week of November we had a number of sewers in the Fort North and also in Bhuleshwar Section, flushed and disinfected with perchloride of mercury.

Schools.

287. In the last days of November I issued a circular to different schools asking them to disinfect the buildings and take other precautions:—"Cleanse thoroughly and disinfect with permanganate of potash, and lime-wash with quicklime the school building and servants' rooms. The disinfection should be done in the following way:—Down each down-take pipe or *moree* a strong solution of carbolic acid, not weaker than 1 in 20, should be poured and afterward the *morees*, rooms including ceilings, and all articles therein should be washed thoroughly with a strong solution of cresol. The walls should afterwards be lime-washed with quicklime. The lime must be quick. The floors of the school ought to be daily sprinkled over with chloride of lime or quicklime. Permanganate of potash should be freely used in the drinking water and in the water for ablution purposes."

Disinfectants distributed.

288. In the beginning disinfectants were distributed in advance of the disease, where the appearance of bubonic plague was apprehended. The disinfectants chiefly used were chloride of lime, carbolic acid, cresol and quicklime. To one side of the street we distributed one disinfectant, and to the other side another. In places where water stagnated, kerosine oil was poured on the surface. When a case occurred, not only was the house infected disinfected, but the adjoining houses also.

289. In December I wrote to the Executive Engineer, Presidency, that the staircases and passages of public buildings in Bombay should be disinfected and dead rats sought for.

Measures.  
Chloride of lime distributed.  
Distribution of disinfectants in advance of the disease.

290. In December we commenced distributing chloride of lime by districts, and by streets in each district in advance of the disease. We also distributed large quantities of quicklime, especially in Kamathipura, but the difficulty was to get people to use it before cases of bubonic plague came.

291. The roads were disinfected with cresol or phenyle.

292. It was fortunate that the contractors did not once fail to supply all the disinfectants required. Messrs. Leopold & Co. carried out orders most promptly.

293. We distributed chloride of lime in Kamathipura for use in the houses, but in many places it was thrown outside the verandahs and not used.

294. There were three stages of popular feeling in regard to our measures:—

1. When people would not believe in Plague measures.
2. When people believed in all measures except the right ones.
3. When people believed in every rumour and would not believe in any measure.

Opinions as to causes of the plague.

295. Whilst some were very angry with us for not giving definite opinions as to where the plague came from, others were ready to affirm that there was no mystery whatever. There are bad drains, and therefore the plague and everything

must be due to the bad drains. Some preached that the population turn to the ways of a rural village. It is marvellous how the attention of the people was fixed on the sewers. In December cases of bubonic plague occurred in Mody Street, and they were ascribed to the opening of the Frere Road. The first case of bubonic plague occurred before the cleaning commenced, two days before cleaning was going on, and six afterwards. It was an illustration of the stupidity of the people who looked to everything except the buildings and the rooms in which the disease was felt for the causes of disease. To 9 out of 11 houses, in Mody Street, in which cases at that period occurred, there were not gullies on one side of the street for either ventilation or light, and yet the people living in such dwellings were 100 yards away for the cause of the disease. This is a good instance of the stupidity of the mass of the population to understand the importance of ventilation and light to the inside of their houses.

296. People will not use their common sense and understand that the atmosphere of the rooms in which they spend 12 out of 24 hours is of much more importance to them than the atmosphere of a sewer 100 yards off.

297. The people thought we were joking when we told them of the Popular idea of our measures. of catching disease. They used to say in anger or in horror, "You are talking upon a human being suffering from the disease as if he was a mad animal." When parties were sent to the country beyond Bombay to disinfect places where the disease had appeared, the people at first looked on the measures of disinfection as a joke. At one place they told an officer engaged in the disinfection that Disinfection in the country treated as a joke. Europeans had come to find amusement. Until the mortality became serious in places outside Bombay, neither the measures nor the people carrying them out were regarded seriously in these places. In Bombay the people are accustomed to see measures of disinfection in operation and a good many are accustomed to the use of disinfectants. The poorest Musalman is accustomed to use loban or frankincense as a perfume or deodorant.

298. The popular dislike to the measures adopted often expressed itself Popular dislike of measures. in street tumults.

299. Perhaps no position could be more painful or humiliating than having to seek shelter while being stoned or insulted by crowds. This was often the fate of our officers. It is marvellous that in these scenes of excitement and turmoil, caused by the removal of the sick to hospital or the disinfection of buildings, no one was killed.

300. In flushing down houses, very often stormy scenes arose. A little Disinfection and street tumults. water perhaps fell and spoiled something or defiled some place, and this little injury or defilement often led to a commotion, while serious injury and loss passed unnoticed. One of the gravest disturbances occurred near the Crawford Market in Shamsett Street long before any cases of disease had occurred there. We were flushing down the gullies and the sides of the houses when water soiled some goods. This soon led to a trifling altercation, crowds filled the street, and we had to take up positions in the verandahs, listening to crowds yelling, while stones were thrown into the verandahs. The slightest indiscretion, and we would have had to fight for our lives. The

police came and rescued us on this occasion. Friendly people, however, always appeared on the scene to give us help. Many of these I had not seen before and have not seen since.

**Port Trust measures.** 301. Early in November I wrote to the Secretary, Port Trust, suggesting to him that the floors of the godowns on the Bunder should be sprinkled with chloride of lime and disinfected. This measure was adopted at once by the Trustees. By the 17th of November the whole of the Port Trust drains had been cleaned and all silt removed.

**Disinfection by chlorine.**  
**The Carbonic Gas Company.** 302. We made use of an apparatus invented by Mr. Sonawala for disengaging chlorine gas under pressure, and we had a number of applications for the disinfection of buildings by it. The apparatus was rather heavy. The Carbonic Acid Company prepared for me a cylinder of compressed chlorine gas, but the Company could not engage to supply it on a large scale. The disengagement of chlorine gas is one of the most effective ways of disinfecting houses in which there is much furniture and in which the staircases are too narrow to admit of the furniture being easily taken down.

**Washermen and Plague.** 303. Cases that occurred amongst *dhobeers* caused us a great deal of trouble because of the disinfection of the clothes. We adopted the following procedure:—All clothes that were not destroyed were soaked in a solution of perchloride of mercury or cresol, and afterwards exposed to the sun.

**Press opinion on the disinfection carried out.** 304. An immense work had been accomplished in disinfection and cleansing as the *Bombay Gazette* wrote: "To stem its ravages an immense work had been done with a sustained energy, never displayed in any other city, with the result that Bombay had become the cleanest city in all the world. Cleansing, disinfecting and lime-washing kept the mortality within limits and reduced the duration of the outbreak in each separate district successively attacked to some eight or nine weeks."

**Measures carried out by the Plague Committee, less drastic, &c.** 305. The disinfection carried out after the formation of the Plague Committee was less drastic and less general than the system carried out before by the Health Department. The system followed by the Health Department from the beginning had for its object the disinfection, not only of the place where the patient was, but the whole building.

**Different systems of disinfection.** 306. The disinfection of a room with perchloride of mercury had not as much effect as the washing down of the whole building with cresol or permanganate of potash. It is doubtful if any system of disinfection is necessary in small ground floor buildings or rooms, the roofs of which can be taken off and a stream of sunlight let in. After light and air have been let in, the only measure necessary to adopt in these buildings is the burning of anything of little value likely to be infected.

307. In the treatment of buildings in the suburbs, all that appeared to me necessary towards the end of the epidemic, was to take off the tiles or roofs and remove the people from the buildings and burn any rags or refuse in the buildings.

308. Lime-washing to be effectively carried out on a large scale requires <sup>Lime-washing.</sup> to be carefully supervised, and it is most difficult to supervise it in time of panic. The men engaged in lime-washing behaved well, and though they had often to enter rooms in which there were dead bodies they did not run away and desert their duties.

309. The real difficulty to be overcome in lime-washing on a large scale, <sup>Difficulties.</sup> is to obtain a strong solution of lime and, having obtained it, to have it applied everywhere. The lime used was of excellent quality and examined daily by the Medical Staff. But it was difficult to ensure the lime solution being applied to the inside of every portion of the building affected. Special attention was given to the lime-washing of bamboo partitions which separate rooms and often form the walls of many rooms; unless great care is exercised and trouble is taken, the inner sides of the bamboo partitions and the interstices are likely to escape the application of the lime. The ceilings also are likely to escape, and where rats are as numerous in houses as they are in this city, the application of lime to the ceiling is of great importance. The advantage of discharging fluids from flushing engines or fire pumps over lime-washing is, that the fluids are discharged with force, that they reach everywhere, and that the interstices between the bamboo partitions and the ceilings, or the dark places at the back of staircases, are not likely to escape the application of disinfecting fluid.

310. In December general lime-washing in advance of the disease was <sup>Lime-washing by the Engineers.</sup> commenced by the Executive and Drainage Engineers at my request. It was admirably and quickly carried out on a very large scale throughout the city and suburbs in spite of the scarcity of labour.

311. In one district, Kamathipura, having a population of 29,203 in 1,344 houses, many of the buildings were lime-washed three times, and if lime-washing could have prevented the spread of the disease, it ought to have checked it in Kamathipura. An immense number of notices were also issued by the Health <sup>Notices issued.</sup> Department for lime-washing. The question often during the epidemic arose as to what influence lime-washing had in preventing plague or the spread of this disease. The evidence so far is, that it had no direct influence. Where lime-washing was carried out, after cases had occurred, it was after the places had been thoroughly cleansed, washed and disinfected. It is therefore difficult to estimate the effect of lime-washing in those buildings where cases had occurred, it having been only one of the measures adopted.

312. It is natural to assume that any measure which has a favourable influence on the health of individuals or on the conditions under which they live must increase their chances of life and powers of resistance to disease.

313. Wherever lime-washing was carried out in advance of cases, it seem- <sup>Effects of lime-wash- ing.</sup> ed to have had little influence in staying the disease. It seemed to me that often the effect of the brightness produced in dark rooms by lime-washing was nearly as important as the action of lime. There can be no doubt that lime-washing had a beneficial effect on the general state of the buildings, but unfortunately the effect of lime-washing on the incidence of bubonic plague was not so marked that it can be estimated. There can be no doubt that general cleanliness has a beneficial effect.

Seldom a recurrence of cases in a house cleansed and vacated. 314. There was, comparatively, seldom a recurrence of cases in a house that had been thoroughly cleansed and vacated for some days.

Results of lime-washing in Kamathipura. 315. In Kamathipura up to the 2nd of March, 89 cases out of 422 cases had occurred in houses that had been more than once thoroughly lime-washed.

316. The following statement will show the number of cases, by streets, before and after lime-washing :—

## KAMATHIPURA 1ST LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
8 to 12 ...	5	0
9 ...	1	0
40 ...	0	1
48 ...	0	1
Total ...	6	2

## KAMATHIPURA 2ND LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
5 ...	1	0
9 ...	2	0
11 ...	1	0
23 ...	3	0
27 ...	1	0
33 ...	1	0
45 ...	4	0
58 ...	1	0
62 ...	1	0
77 ...	1	0
79 ...	2	0
84 ...	1	0
85 ...	3	0
87 ...	2	0
88 ...	3	0
92 ...	2	0
112 ...	1	0
116 ...	2	0
118 ...	0	2
124 ...	2	0
153 ...	1	0
155 ...	1	0
163 ...	1	0
168 ...	0	1
179 ...	0	1
Total ...	37	4

## KAMATHIPURA 3RD LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
6 ...	6	0
11 ...	1	0
32 ...	2	0
37 ...	0	1
45 ...	1	0
47 ...	1	0
52 ...	1	0
64 ...	1	0
69 ...	1	0
73 ...	1	0
77 ...	1	0
80 ...	2	0
98 ...	1	0
103 ...	0	1
106 ...	1	0
118 ...	1	0
122 ...	2	0
125 ...	0	1
146 ...	0	1
152 ...	1	0
180 ...	2	0 The house is vacated.
182 ...	1	0
Total ...	27	4

## KAMATHIPURA 4TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
20 ...	4	0
24 ...	1	0
26 ...	1	0
28 ...	3	0
30 ...	2	0 Vacated.
34 ...	2	0
46 ...	1	0
50 ...	0	1
52 ...	2	0
54 ...	1	0
56 ...	2	1
58 ...	3	0 Vacated.
62 ...	2	1
64 ...	1	0
76 ...	1	1
77 ...	2	0
84 ...	1	0
95 ...	0	1
97 ...	1	0
Total ...	30	5

## KAMATHIPURA 5TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
25	0	1
28	1	1
43	5	1
48	1	1
51	1	0
53	2	0
58	1	0
70	8	1
77	1	1
90	1	0
91	1	0
117	1	1
119	1	0
123	2	0
127	2	0
143	1	0
149	2	0
152	3	0
156	4	0
157	1	0
159	1	0
161	0	1
166	1	0
Total	41	8

## KAMATHIPURA 6TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
1	1	0
2	5	0
6	1	0
7	1	0
12	2	0
15	2	0 Vacated.
17	2	0
23	3	0
24	1	0
27	2	0
33	2	0
36	2	0
43	1	0
53	1	0
54	1	0
55	1	0
56	1	0
69	1	0
76	1	0
102	1	0
Total	32	0

## KAMATHIPURA 7TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
4	2	0
9	0	1
19	1	0
21	2	0
24	1	0
29	4	0
32	0	1
42	0	1
44	2	0
47	1	0
53	1	0
65	3	0 Vacated.
67	2	0
69	2	0
75	2	0
94	2	0
107	0	1
Total	25	4

## KAMATHIPURA 8TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
7	3	0
12	1	0
16	1	0
27	1	0
33	1	0
38	1	0
53	1	0
56	3	0
58	3	0
60	1	0
64	2	0
76	2	0
79	0	1
105	1	0
114	1	2
116	0	3
118	3	1
119	1	0
121	2	0
123	1	0
125	2	0
129	1	0
133	0	1
135	0	1
146	4	1
149	1	0
157 to 167	1	1
Total	38	11

## KAMATHIPURA 9TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
6	1	0
8	2	0
10	3	0
11	2	0
12	1	0
22	2	0
25	2	0
34	1	0
36	1	0
48	2	0
54	2	0
58	1	1
65	0	1
67	0	1
76	1	0
79	1	0
83	0	1
97	1	0
112	1	0
145	2	0
Total	26	4

## KAMATHIPURA 12TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
3	1	0 Vacated.
7	1	0
8	0	1
13	1	0
15	2	0
20	0	1
30	1	2
40	1	0 Vacated.
42	0	2
46	0	2
48	3	0 Vacated.
50	1	0
53	1	0 Vacated.
55	1	0
59	1	0
60 to 81	6	0
Total	20	8

## KAMATHIPURA 10TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
19	1	0 Vacated.
24	1	0
27	1	0
54	1	0 Vacated.
55	1	0
57	2	0
81	0	4
90	0	1
102 to 144	2	3
Total	9	8

## KAMATHIPURA 13TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
30	1	0
44	1	0
50	0	1
65	0	1
70	1	0
74	3	0 Vacated.
75	2	0
80	1	0
84	1	0
87	2	0
95	0	0
97	2	0
98	2	0
100	1	0
105	1	0
108	2	0
111	0	1
119	1	0
125	1	0
139	2	0
142	1	0
147	0	1
176	2	0
183	2	3
196	1	0
Total	30	7

## KAMATHIPURA 11TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
3	1	0
8	0	2
15 to 19	9	0 Vacated.
21	3	0
26	0	1
31	0	0
32 to 34	0	0
40	0	0
43	3	1
45	2	0
47	6	0 Vacated.
70	3	0
Total	27	4



## KAMATHIPURA 14TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
7 ...	1	0
9 ...	1	0
11 to 13 ...	1	0
18 ...	0	1
23 ...	1	0
25 ...	2	0
28 to 30 ...	1	0
31 ...	1	0
48 ...	1	0
53 ...	1	0 Vacated.
57 ...	0	1
66 ...	1	2
69 ...	2	0
71 ...	2	1
90 ...	1	0
Total ...	16	5

## KAMATHIPURA 15TH LANE.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
9 ...	1	0
11 ...	1	0
16 ...	4	0
17 ...	0	1
18 ...	1	0
28 ...	1	0
40 ...	2	0
43 ...	4	0
45 ...	2	0
49 ...	4	0
51 ...	2	0
52 ...	1	0
56 ...	2	0
62 ...	2	0
64 ...	2	0
Total ...	29	1

## VARSOVA STREET.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
Cook-room on the side of house No. 38	2	0
38	1	0
Total ...	3	0

## BAZAR ROAD.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
14 ...	1	1
21 ...	1	0
31 ...	1	0
49 ...	1	0
67 ...	2	0
132 ...	1	0
149 ...	2	0
153 ...	0	1
173 ...	1	0
Total ...	10	2

## BAPT Y ROAD.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
26 ...	1	0
60 to 80 ...	4	0
123 ...	0	2
127 ...	1	0
135 ...	0	1
Total ...	6	3

## CENTRE ROAD.

Number of Houses.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
91 ...	1	0
96 ...	1	0
124 ...	2	0
Total ...	4	0

## GRANT ROAD—Kamatbipura side.

Number of House.	Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.
203 ...	4	0

DUNCAN ROAD—Kamathipura side.				KAMATHIPURA.			
Number of House.		Number of Bubonic Plague Cases before Lime-washing.	Number of Bubonic Plague Cases after Lime-washing.	No. & Name of Lane.		Number of Bubonic Plague Cases in each Lane before Lime-washing.	Number of Bubonic Plague Cases in each Lane after Lime-washing.
623	...	1	0	1	...	6	12
628	...	1	0	2	...	37	4
				3	...	27	4
				4	...	30	5
Total	...	2	0	5	...	41	8
				6	...	32	0
				7	...	25	4
				8	...	38	11
				9	...	26	4
				10	...	9	8
				11	...	27	4
				12	...	20	8
				13	...	30	7
				14	...	16	5
				15	...	29	1
				Varsova Street		3	0
				Bazar Road		10	2
				Bapty Road		6	3
				Centre Road		4	0
				Grant Road—Kamathi-			
				pura side	...	0	4
				Duncan Road—Kama-			
				thipura side	...	2	0
				Stable Street	...	4	5
Total	...	4	5	Total in Kamathipura.		422	89

317. The Return of the number of houses now shown in which cases of bubonic plague occurred, and which were thoroughly flushed, cleansed, disinfected, and lime-washed by the Health Department is of interest.

Number of houses cleansed and disinfected by the Health Department in the last 4 months of 1896, and in January, February and March 1897.	Wards.	September.	October.	November.	December.	January.	February.	March.	Total.
	A	8	2	38	89	138	75	46	416
B	96	118	73	108	75	75	37	582	
C	13	56	92	346	337	193	64	1,101	
D	3	8	20	146	230	97	134	638	
E	12	38	67	386	418	473	147	1,541	
F	3	2	5	46	111	166	86	419	
G	3	.....	1	55	132	284	119	594	
Total	...	138	244	296	1,176	1,441	1,363	633	5,291

Buildings lime-washed by the Engineers.

318. The large number of houses lime-washed by the Building and Drainage Departments will be seen from the following letter from the Executive Engineer, Mr. Murzban:—"I have the honor to inform you that about 5,457 houses and sheds were lime-washed and disinfected by the Building and Drainage Branches of my department up to the 3rd of March 1897."

319. As soon as I was convinced of the influence of moisture in favouring the disease, I recommended that the water-supply of all houses where the water produced dampness should be cut off. After a time I advised that the water supply of the poorer class of buildings, that happened to be ill-ventilated, ill-lighted and overcrowded, should be stopped, and water pipes put up in the streets for the use of the people. It was a question between dampness inside buildings or outside, between moistness inside dark rooms and a little water splashed outside in the public streets and in the open air. From the beginning wherever the water-supply caused dampness it was cut off. In one of the districts, Kamathipura, the whole of the water-pipes inside the buildings were cut off and stand-pipes put up in the public streets. Later on I recommended that the watering of the roads should be stopped in the damp and overcrowded districts. This measure was carried out, and seemed to be distinctly beneficial.

Cutting off the water supply. Influence of moisture.

Stoppage of road-watering.

320. Previously in 1894-95 I drew attention to the danger of placing water-pipes in positions where the waste of water might cause dampness. "I have described before and I need not describe at length what may be seen in the dwellings of the poor called 'challs.' There is a water pipe on each floor; it may be at the end of a passage between rooms, or it may be in a central space in the middle of a line of rooms, or it may be in a cemented space between rooms, but be it where it may, water runs all day and all night, and when clothes are being washed the floors and the walls are splashed and made damp. It is difficult to suggest a remedy. A better cock might lessen waste and do good; meters might do a little good, but I do not think any measure, except prohibiting the supply of water inside dwellings of this class and cutting off the supply from such buildings as have not an open space connected to a drain upon which the tenants can bathe and wash their clothes and utensils, will do much good."

Dampness and dangers from it.

321. A few dust-storms seemed to be followed by a decrease in the number of cases.

Dust-storms and their effect.

322. All temporary huts in which cases occurred were pulled down and burnt. Chawls containing 114 rooms and 2 foul milch cattle stables were burnt down in Chaupati. These chawls prove but too well that an open space outside buildings will do little good if people build rooms inside into which light cannot enter. These lines of chawls had originally open passages between them some 15 feet wide and an open space all around and were excellent when first built. But what occurred? Across the open passages mats were stretched, and to support the mats, bamboos were erected, and in time the bamboo supports were plastered with earth, so that the passages were divided by the bamboo walls into rooms, with the result that the inner rooms were in complete darkness. As in a ship on the open sea, with pure air around and foul vapours inside, when typhus fever breaks out and spreads in darkness and overcrowding.

Burning of huts and bad dwellings, e.g. Chowpatty chawls.

323. From the first the Health Department took the view that bamboos and other materials in the structure of huts or buildings might give shelter to the disease.

The treatment of the poorest buildings.

324. In the treatment of the poorest class of house, where the dwelling was not unfit for use we modified the measures, and I did not consider it necessary to burn them down, although some clamoured for fire; we took the roofs off and flushed them out.

325. The Mill-hands gave more assistance than any other class. Being accustomed to taking off tiles, they assisted in this work and in removing boxes, and were not so obstructive as some other classes.

Obstructions to light removed.

326. All obstructions to the entrance of light were broken down as far as practicable and tiles taken off many houses so as to let in light and air. We employed in each section men whose profession was the turning of tiles. In every portion of the city the removal of tiles was carried out by the Health Department in the most thorough manner. Up to the time of the appointment of the Plague Committee, thousands of persons were removed from infected houses. One of the anxieties of the Plague Committee was the fear that as the monsoon approached there would not be house accommodation for the people removed from dwellings by the Health Department.

Anxieties of the Plague Committee because of the number of people turned out of their homes by the Health Officer.

327. From five chawls occupied by a number of Hindoos in which 17 cases had occurred, in one Wadi in Mugbhat all the people were removed.

Cases occurring on Malabar Hill.

328. Cases in the beginning of February became more frequent on Malabar Hill, and we demolished or burnt a large number of servants' quarters and huts. We proceeded regularly over Malabar Hill flushing, disinfecting and lime-washing the servants' quarters.

329. In Mazagon the Kolis themselves did a great deal of disinfection. One morning I advised the people living in a group of chawls in Parel to demolish the mud walls erected in front of the verandahs—these walls forming double rooms—and remove other obstructions, and I also asked them to take off some of the tiles from the roofs. A couple of days afterwards I was surprised to find that not alone had they done all which I had suggested, but that they ascribed their immunity to the measures taken.

In February the Health Department stopped from demolishing many buildings.

330. From the month of February the demolition of buildings by the Health Department was stopped, but the department still continued to demolish rooms in verandahs and to break down walls and partitions.

331. A large number of buildings were condemned by the special officer, Surgeon-Lieut.-Col. K. R. Kirtikar, who had been appointed to report on buildings unfit for human habitation.

Examination of buildings.

332. Since the 5th of May 1897 a regular examination of houses in Kamathipura, Dhobi Talao and Mazagon has been proceeding. Up to the 2nd of June 120 houses have been condemned. Altogether 8,504 rooms have been inspected.

333. The preventive measures adopted may be classified as follows :— Preventive measures.

- Constant inspection of buildings. Cleansing and disinfection of buildings.
- Burning of all huts and temporary structures in which cases have occurred.
- Erection of shelters for those removed from infected buildings.
- Erection of segregation hospitals for different communities.
- Restrictions on the use of godowns or warehouses.
- Condemnation of buildings unfit for human occupation.
- Free distribution of disinfectants.
- Lime-washing of buildings by localities.
- The stoppage of the water-supply inside buildings where necessary.
- The suspension or reduction of the watering of roads.
- The cleansing of the surface of the ground.
- The cleansing of sewers.
- The preparation of districts against the coming of the disease by the constant cleansing and disinfection of the sewers.

334. On the 30th of September I urgently recommended that all the Measures in godowns. grain in the godowns on the Port Trust should be taken out and put in the open air and well exposed to the sun ; that all the godowns should afterwards be thoroughly flushed down with phenyle or cresol and disinfected by sulphur and dammer fires. And I also suggested that all the grain sweepings from granaries should continue to be burnt as we had been doing.

335. The Port Trust most readily from the beginning did an immense Port Trust work. amount of lime-washing and cleansing at our suggestion.

336. I had reported to the Commissioner that notices for the lime-wash- Lime-washing, closing of godowns. ing of many private premises had been prepared and served, and that the disinfection of godowns in which suspicious cases had occurred had been carried out from the first, but that it was difficult to decide for what period they should be kept closed.

337. The Commissioner inspected with me a number of godowns and Inspection of godowns by the Commissioner. shops, and expressed the following opinion :—

In accordance with the tenor of Professor Haffkine's opinion and after consultation with you on the spot, I am of opinion that all these places must be disinfected thoroughly and the grain and other goods inside them taken out and exposed to the sunlight or otherwise disinfected as the occasion may demand.

From our inspection I should say it would be difficult to imagine more noisome and dangerous places, and, situated as they are in many cases right under houses where bubonic fever has occurred, it is absolutely incumbent that they should be thoroughly dealt with. The question is a difficult and important one, and I would request you to serve the notices without delay and then carry out the operations as rapidly and thoroughly as possible, showing all reasonable consideration to the owners with a view of causing them the minimum of loss and inconvenience that these necessary measures must involve.

Complaints against our measures.

338. I wrote in October, as I had received a large number of complaints against our measures and protests against our policy, that—

Loss caused by measures.

“ Any loss from the measures now being taken to stamp out the disease that has now been officially called Plague does not really concern me as Health Officer, however much I may regret the loss and injury these measures may cause. Either the disease is to be controlled by the most effective measures known, irrespective of all loss or individual hardship.”

Progress in disinfection by October.

339. To indicate the great progress made in the disinfection of godowns by the 3rd of October, I will refer to the following letter from the Commissioner :—

Letter from the Municipal Commissioner.

In continuation of our yesterday's conversation regarding ventilation and disinfection of grain godowns, I have the honour to inform you that I have to-day addressed the Chairman, Port Trust, and asked him to lime-wash all the grain godowns in the vicinity of Mandvi Bunder and place disinfectants therein.

I believe that you are already dealing with the question of taking out the grain bags stored under chawls or infected houses for ventilation and disinfection in the sun. This should be done in all cases where you deem it necessary, and I must request you to enlist, as far as possible, the good offices of the parties concerned and avoid doing any damage to the bags.

Treatment of godowns.

340. In the treatment of godowns over which cases of Bubonic Plague had occurred, we commenced by forbidding the use of the godowns for twenty days. This measure had the effect of practically putting the buildings in quarantine—a very effective way of discouraging people from going to the buildings. In the meantime, all that could be taken out from the godowns was removed and placed in the sun, and the godowns flushed out with disinfectants. Over each godown and shop a Police Ramosi was placed. Disinfection was continued during twenty days, and sulphur was freely burnt inside and outside. Sulphur fumes were most effectual, in the way of discouraging people from collecting in infected buildings. The sulphur fire was a disease signal and the fumes being unpleasant people liked to avoid them.

Sulphur fumes.

341. In October I reported a number of godowns over which cases of Bubonic Plague had occurred in dwelling rooms. In these godowns different kinds of merchandise were stored. In my opinion it was necessary that they should all be emptied and the goods kept in the sun until such time as the buildings had been disinfected, cleansed and lime-washed. We found the bridges, footpaths, and open places in Mandvi excellent positions for exposing goods to the sun.

342. The closing of godowns caused many complaints and led to many deputations. I think there can be no doubt that the storage of articles of food under dwellings should be absolutely prohibited.

Advice of Mons. Haffkine.

343. Shops were closed for three days, and any articles likely to have been infected were either destroyed or exposed to the sun or disinfected. Professor Haffkine strongly supported the measures for the disinfection of godowns and our recommendations in regard to the exposure of articles in the sun. The result of the measures adopted has been to justify the wisdom of his advice. The treatment of articles found in shops was surrounded with difficulties. It was difficult to exercise any discretion. All we could do was to select the articles—the

most likely to attract and retain contagion—and disinfect them ; and if they were of little value, or if they were articles like sweetmeats that could not be disinfected, we had to destroy them. We destroyed large quantities of food preparations. From godowns immense quantities of grain sweepings were taken to the incinerator and burnt. From one godown as many as 51 cart-loads of grain sweepings were removed. These sweepings were intended for the adulteration of grain, and were stored in bags. They had been collected from the footpaths, and even from the gullies by out-caste women and children. It had become a form of industry—this sweeping up of dirty grain lying on the footpaths in front of the godowns or even in the sewage ways and this grain went back into the food-supply of people who would not touch it while it lay on the roadways.

344. It was extremely difficult to keep people from selling food in places where there had been, or even where there were, cases of bubonic plague. Sale of food where cases occurred.

345. In November quantities of cream were being imported from Guzerat in dirty cans. I warned the importers that a rigid examination would be made and we destroyed a quantity of rancid cream. Bad cream.

346. When shops had been closed on account of cases of bubonic plague in the same buildings, permission to re-open them was given only on the following conditions :—That the owners consented to remove the goods to an open piece of ground and expose them to the sun, and that they afterwards lime-washed the inside and outside of the shops. The closing and re-opening of shops.

347. The following statement shows the number of godowns and shops closed :—

Number of godowns closed by notice for cleansing and disinfection...	165
Without notice ... ..	60
Total ...	225
Number of shops closed by notice ... ..	121
Without notice ... ..	16
Total ...	137
Total godowns and shops closed ...	362

*Form of Notice to vacate Godown or Shop.*

Whereas a dangerous disease, namely, bubonic fever has occurred in, or in the neighbourhood of, the house in which your\* abovementioned is situate, and I am of opinion that the cleansing and disinfecting of your said \* and of all goods and other articles stored or kept therein will tend to prevent or check the spread of the said disease, now pursuant to the provisions of sections 425, 427 and 434 of the City of Bombay Municipal Act, 1888, and in exercise of the powers thereby respectively conferred, and for the purpose of giving effect to and carrying out the temporary regulations and special

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\* Godown or shop.

measures sanctioned by Government as already notified in Public Notice, dated the 6th October 1896, I do hereby require you forthwith to vacate the said \* and to remove all goods and other articles therefrom until such time as the same shall respectively have been thoroughly cleansed and disinfected as hereinafter required.

The said \* must be thoroughly cleansed, disinfected and lime-washed to my satisfaction.

All goods and other articles kept and stored in the said \* must be laid out in and exposed to the sun or otherwise disinfected and purified to my satisfaction, or, in case upon examination it shall appear that the condition of any of such goods or articles is such as render their destruction necessary, the same must be forthwith destroyed, and I do hereby give you notice that, should I deem it necessary to do so, I shall cause any or all of the measures and precautions aforesaid to be carried out under my orders.

348. We did not receive many applications for compensation. One of the complainants was the Manager of a Dairy Company, and he considered it a grievance that the dairy had been closed and disinfected because of a death from bubonic plague in the building.

The Military lines  
in the Marine Lines.

349. In February I wrote to the Commissioner, and suggested that the attention of Government should be immediately drawn to the insanitary condition of most of the servants' quarters in the Marine Lines. There were few rooms occupied by servants in the Marine Lines that had a window.

350. General Gatacre, Commanding the District, took a great interest in the sanitary condition of the lines, and had supported all measures advocated for their improvement. On the 9th of February, I wrote to General Gatacre proposing the destruction of the worst of the buildings or the worst of the rooms, and to that letter I received the following reply, dated the 10th of February :—

Destruction of ser-  
vants' quarters in  
the Marine Lines.  
General Gatacre  
thereon.

In reply to your letter No. 41442 of yesterday, I have the honour to inform you that I am quite in accordance with the proposal to destroy these quarters, as they are insanitary to a degree and a menace to the health of officers occupying the quarters adjoining; but I cannot concur in the proposal to allow the work to be carried out by the Municipality, unless they do it on very different lines to those on which they destroyed the Chowpatti huts. It is necessary to consider the result of handing over the buildings to the Municipality to set fire to.

1. The Marine Lines would be destroyed as a building site for 50 years, all the fine trees would be ruined, for it is impossible to burn down the quarters without also destroying the bungalows which are joined to them by matting sheds and covered ways.

2. \* \* \*

3. I therefore propose, as the lines are in military charge, that the work be carried out by the Executive Engineer under my orders; the demolition and cleaning the site shall be done thoroughly in the most effectual and economical manner.

4. But it is manifest that without servants these lines are useless, and temporary quarters will have to be erected for the servants of such officers who may wish still to remain there.

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*Note.*—The powers, duties and functions conferred or imposed upon or vested in the Commissioner by section 434 (1) and 437 (3) of the Act have been duly delegated under section 68 of the said Act to \_\_\_\_\_, who has authority to see that the provisions aforesaid, as well as the temporary regulations and special measures abovementioned, are duly carried out.

\* Godown or shop.



I have no money for this purpose; and failing the erection of quarters, officers must all leave the lines and claim Presidency house rent.

5. I therefore propose that, in such cases where the houses are occupied, my Executive Engineer may be supplied with the necessary funds for building these huts; it will be a small matter, but it is an urgent one.

6. Some four or five days ago I wrote to Lieut.-General Nairne regarding the destruction of these quarters, and he concurred in my proposals.

351. On the 25th February I wrote as follows to the General :—

In reply to your No. 133-15--9627 of 10th instant, I have the honour to earnestly urge Health Officer's letter to General Gatacre. that the officers living in jowli-covered bungalows in the Marine Lines be at once requested to leave them, and that, in addition to the thorough measures you are now taking for the improvement of the servants' quarters, the jowli roofs be removed and all partitions obstructing the circulation of air broken down. I apprehend that there is to all living in the jowli-covered bungalows (enclosed as they are under roofs carried out too far and too low) the greatest danger of infection.

352. Dr. Waters came frequently to Mandvi and gave us assistance. Dr. Waters' help. He took much interest in the measures adopted in Kamathipura, and of friends he was the first to publicly advocate lime-washing on a large scale, and to point out the danger that lurked in damp houses. In all our measures we had his support. Amongst the many friends who came to encourage and assist us at work in the week of highest mortality and greatest anxiety, I must mention Mr. Grattan Geary, who witnessed some of the gruesome and heart-rending scenes with which the Officers of the Health Department were only too familiar, and he was one of the few—the very few—who never lost confidence in the success of the measures so efficaciously carried out.

353. Professor Muller was often present in Mandvi and gave much assistance in the removal of the sick, often bringing up the ambulance-van, and at all times, as I believe, we had his cordial support in our measures.

354. On the 31st December, I wrote that Major Roughton had kindly Volunteer aid. consented to allow a number of the Volunteer Artillery to assist in the inspection and disinfection of buildings and the removal of patients to hospital, and I requested the approval of the Commissioner to the employment of volunteer aid.

355. I expected much from the assistance of the Volunteer Artillery, and The assistance that was most needed. I was not disappointed; and it was during that week in Christmas, when we, who had seen death in many forms, were almost appalled by the scenes that accompanied the removal of the dead—the mourning, the shrill music, the cries and the processions of women in anguish and in grief, and in thousands offering oblations of water to the Gods.

356. Major Roughton and his Volunteers did brave service. In the early morning they came to Kamathipura, and wet from the washings of the houses in which the plague-stricken had fallen, and soiled from the loathsome tasks they had often to perform after a hurried meal, they returned to work again in the evening, and till late in the day were busy in the cleansing and disinfection of houses. In such wise the Artillery Volunteers and Major Roughton passed Christmas week with us.

357. It is difficult for me to thank every one who assisted us, and especially the medical men who gave help, amongst whom I would mention the Hon'ble Dr. Bhalchandra Krishna, Dr. Arnott, Dr. Viegas, Dr. Ismail J. Mahomed and Dr. Katrak, Rao Saheb Vandekar, Mr. Khyraz and others.

Organization of Relief Fund.

358. In the early part of January I wrote to the Press drawing attention to the distress amongst the poor, and a subscription was opened and a fund was collected through the generous assistance of the Collector of Bombay, Dr. John Pollen. In this fund the Assistant Health Officer, Mr. Leask, took a warm interest, and it was through his assistance that the fund has been generally distributed.

359. From many medical men I constantly received most useful information. Dr. E. F. Underwood and Dr. C. F. Underwood gave me frequently information and assistance, and such information, wherever coming from, helped me greatly.

Old and bad houses.

360. The first street of buildings, the infected places and the privies of which had already been disinfected and lime-washed by the Health Department that was treated on a large scale was in the Mandvi Ward and in the Umarkhadi Section. Peru Havildar Lane is the name of this street, and there were a number of houses in it very old and dilapidated, the inner rooms of which were in complete darkness and all of which had water-pipes inside the houses. To the dilapidations I did not object, because the crevices gave openings for the air to enter. In this street 17 houses were condemned.

Visit of H. E. the Governor to the slums.

Old and bad houses: a street of.

361. The following description of the insanitary buildings in this street is of interest at any time, but more especially as some of the houses had been inspected by His Excellency the Governor in 1896. His Excellency came through the lane late at night with me, and one of the places he inspected by the light of a weaver's dim lamp—a few threads of cotton in oil lying on a plate—was a building without any means of ventilation except the front doors and a little space on the side of each privy and havingholes on the ground floor in which poor weavers sat when they worked. Except from an open space near the privies and the front door not one of them had any other means of air and light. The buildings were occupied by a poor class of Mussulman.

The description proceeds: "I have completed a thorough inspection of all the houses in Peru Lane with a view to action being taken to their being either condemned or rendered more suitable for human habitation. The following houses are, in my opinion, unfit for human habitation for the reasons briefly given opposite each:—

362. *House No. 46 to 52.*—"No plinth and floor not paved. East wall of irregular insecure planks. West wall (by which runs a narrow gully) of rough brickwork about 6 inches thick, and leaning towards the west by weight of upper floors and roof. The rooms and passages are low and the majority of them are without means of proper ventilation, and are always pitch dark. The upper floors are shaky in many places. A large number of cases of plague died in this chawl."

363. *Houses Nos. 26 to 28.*—"Two out of three rooms on ground floor have no windows nor other means of obtaining light and air, and the third room has a window opening into the 'nahni.' The first floor has one out of two rooms

uninhabitable on account of its having no means of obtaining light and air. There is no gully on either side and there was one death of the plague in this house."

364. *Houses Nos. 22 to 24.*—"Of two rooms on ground floor one had no means of getting sufficient air and light, and the other had only a window opening into 'nahni.' Rooms on first floor have no means of obtaining sufficient air and light. Casing of roof shaky and insecure in some parts."

365. *Houses Nos. 9 to 11.*—"Rooms on ground floor have no means of obtaining sufficient air and light."

366. *Houses Nos. 17 to 19.*—"One room on ground floor unfit on account of no means of getting air and light; also two rooms on first floor. Morees in attics are over rooms below, and down-take pipes run through the house which constitute a permanent risk of leakage and flooding."

367. *Houses Nos. 21 to 25.*—"Of three floors all rooms are unfit on account of darkness and want of ventilation. A small quantity of light exists in the house on account of holes having been made in the roof. There were some deaths in this chawl from the plague."

368. *Houses Nos. 27 to 33.*—"Most of the rooms are pitch dark and have no means of obtaining light or air. The staircase is dark and narrow and the waste-water pipe runs within the house."

369. *Houses Nos. 43 to 45.*—"No gully on either side. Several rooms on ground floor, first floor, and second floor are unprovided with sufficient means of obtaining light and air. One low and cramped room is used as an opium den. Attic only ventilated by hole in roof, which has to be closed in wet weather. Ladders to second floor and attics are open and unsafe for small children."

370. *Houses Nos. 47 to 53.*—"On account of there being no side gullies, several rooms on ground floor and on west side upper floors are dark and without sufficient ventilation. Ladders open and narrow and dark. The loft which is built like an attic is dirty, and so built as to be impossible to be kept clean."

371. I would add to the description given by the Medical Officer that the rooms, when closed at night, had no means of ventilation except through crevices in the walls.

372. I would draw attention to the following description of five buildings condemned by the Health Department and which formed the subject of proceedings before the Presidency Magistrate, who passed orders prohibiting their use as human dwellings. The Plague Committee, owing to the apprehension as to the difficulty of finding room for the population before the monsoon, permitted them to be re-occupied.

373. *Nos. 24 to 26, Nowrojee Hill 1st (north), Vithal Maneck.*—This tenement has *nine small rooms with thirty-three occupants.* On the ground floor one room in the north-east corner has no means of obtaining sufficient light and air. All the ventilation which most of the rooms on the south side have is by their opening into a row of low, dark, ill-ventilated shops. The upper floor is filthy and under a leaky roof. The floor is imperfect, being very much broken. The

partitions are of stick and bamboos and the rooms depend on small sky-lights (only of use in dry weather) for their light and air. The whole tenement within presents a dilapidated and squalid appearance.

374. Nos. 30 to 34, *Nowrojee Hill*, 1st (north), Gopal Govind.—The tenement has *thirteen small rooms with thirty-nine occupants*. The ground floor is very dark and has *several rooms* without the means of obtaining sufficient light and air. The floor is on a lower level than the road. The appearance of the *upper rooms* is very squalid and the floor is shaky, and gives when walked on, and there is not sufficient means for obtaining light and air. The roof is leaky and there is only *one side gully*.

375. No. 46, *Nowrojee Hill* 1st (north), Mahomed Ahmed.—This tenement presents a squalid appearance. The floor is on a lower level than the road. The only means of ventilation on the *ground floor* are *one small gully window* on the *north* and *two* on the *south side*, and there are no means of getting sufficient light. The *upper rooms* depend entirely on *small sky-lights* on the *roof* for light and air, and these cannot be used in wet weather. There are altogether *eight rooms* and thirty occupants. The *roof* is *leaky*, and the partitions, which are incomplete, are of sticks and bamboo work.

376. Nos. 62-64, *Nowrojee Hill* 1st (north), Ramchandra Khundojee —On the *ground floor* there are *four rooms* which had *nineteen occupants* and these are not provided with means of obtaining sufficient ventilation and light. The whole of the floor is not paved and it is flush with the road, there being no plinth; on the *south side* there is a row of *low dark shops* with *thirty-one occupants*. The shops have no means of getting enough light and air, *eight rooms* on the top floor have not sufficient means of light and air, the *walls* are dirty and ill-kept, and the roof does not give sufficient protection from rain.

377. No. 70, *Nowrojee Hill* 1st (north), Khundojee Hunmuntrao.—This tenement consists of a *stable* and *one room* screened off by imperfect plank partitions from the stable. The room has not sufficient means of light and air.

Table showing the number of Tenements inspected and declared by Surgeon-Lieut.-Col. KIRTIKAR partly or wholly unfit for human habitation from 27th January to 30th June 1897.

Wards.								From 27th January to 31st March 1897.	From 1st April to 30th June 1897.	Total.
A	...	...	...	...	...	...	215	No. of Tenements.	No. of Tenements.	251
B	...	...	...	...	...	...	11	36	37	48
C	...	...	...	...	...	...	263	161	424	
D	...	...	...	...	...	...	104	73	177	
E	...	...	...	...	...	...	156	.....	.....	838
"	Kamathipura Section						.....	623	}	
"	Mazagon Section						.....	36		
"	Other Sections						.....	23		
F	...	...	...	...	...	...	81	.....	81	
G	...	...	...	...	...	...	84	.....	84	
Total...								914	989	
Grand Total...								.....	.....	1,903

378. I understood that a clear sweep was to have been made of the ill-lighted and vast tenement houses when the Plague Committee was appointed, but I was surprised, if not pleased, to find that the duty of the Committee, after a short time, was not to demolish houses, but to put back before the rains the people who had been removed from buildings by the Health Department.

Plague Committee hesitate to do what the Health Department did.

379. During the epidemic great need for better communication across the Island was felt. There was a great want of cross-roads from east to west not only in the suburbs but in the city proper.

380. On the 31st of October the examination of all outward traffic on the G. I. P. Railway began at the Bori Bunder and Byculla Stations, and on the 1st of November on the B. B. & C. I. Railway at Grant Road and Bandra. The arrangements were made by the Health Department.

Railway Inspection.

381. For the inspection of passengers at all stations in Bombay, it was estimated that 56 medical men would be necessary.

382. On the 20th of January all the medical men engaged in railway inspection were placed under Surgeon-Major Street.

Railway and Medical Staff under Dr. Street.

383. On the 10th of February, Government issued a notification in regard to the inspection of railway traffic :—

1. Every train coming from the direction of Bombay to any of the stations to which these rules may be declared by Government to be applicable shall be stopped at such station and shall not be taken further until the inspection provided by these rules has been carried out, and until the Guard in charge of such train has obtained a certificate from the Chief Medical Officer in charge of the inspecting staff to the effect that all persons proceeding further by the said train, whether railway servants or passengers, are free from Bubonic Plague.

Government Notification. Railway Inspection.

2. Every such train shall be emptied for inspection of the passengers in such manner as the Chief Medical Officer on duty may direct, and all such facilities shall be afforded by the servants of the railway company as the Chief Medical Officer on duty may deem to be necessary for the purpose of inspecting,—

(a) Persons who have come by such train, whether they intend to proceed by it or not ;  
and

(b) Persons who intend to start from any of the said stations and to travel by such train.

In particular the doors of all railway carriages shall be locked at the station at which the train last stops before arrival at the station appointed for the inspection of passengers under these rules.

3. The Governor-in-Council may appoint any person or persons, by name or by virtue of office, to be the Inspecting Medical Officer or Officers for the purposes of these rules, and may cancel any such appointment.

4. Inspecting Medical Officers appointed under these rules are empowered to examine all persons arriving by or intending to leave by the trains mentioned, and to detain persons suffering or suspected by them to be suffering from bubonic plague in such places as may be appointed for the accommodation of such persons respectively.

5. The Police shall act under the orders given by the Chief Medical Officer on duty under these rules with regard to compelling persons to submit to such regulations as may be made or approved by the said officer for the purpose of inspection and with regard to the detention and segregation of persons suffering or suspected to be suffering from bubonic plague.

6. Disobedience to any orders issued under the above rules, Nos. 1, 2, 4, & 5 will subject the offender to a prosecution under section 188, Indian Penal Code.

Question of inoculation with a prophylactic serum and Railway Inspection.

384. The question as to whether people who had been inoculated should be allowed to escape the restrictions of railway inspection came up for consideration. I had to reply that inoculation did not confer any privilege, nor would it secure relaxation of the rules of inspection, but that the fact of inoculation should be brought to the notice of the Examining Officer who would consider each case.

Panic.

385. After the disease had acquired its maximum and greatest intensity, and the cause for panic had really passed away, the panic became most intense. It seemed as if the people had been frightened by a nightmare.

Railway Inspection of people coming into Bombay.

386. On the 10th of February I suggested that in view of the probable appearance of bubonic plague in many parts of the Bombay Presidency, the system of examination through which passengers leaving Bombay had to pass should be extended to all passengers entering Bombay. At this period patients were being brought from Bandora and Coorla to Bombay. I thought it probable and that indeed it might be taken for granted that, when bubonic plague was prevalent outside Bombay, there would be a rush of people towards this city, as an idea had arisen that the disease was milder in Bombay than anywhere outside. I recommended that all persons found ill on the way to Bombay, should be compulsorily removed to hospital.

Difficulty of Railway Inspection.

387. There is a considerable amount of difficulty in making good arrangements for the inspection of railway passengers. For instance, a small matter like this—the want of keys to open carriage doors—caused delay and gave trouble to Medical Officers who were not supplied with keys to open the doors of the carriages. The thermometers ought to be very good ones for railway inspection. If they are not sensitive, either passengers are detained longer than need be, or the true temperature is not taken.

Port Trust operations.

388. In the beginning of March the Port Trustees organized parties for the inspection of properties on the Port Trust estate on the foreshore. His Excellency the Governor took much interest in these inspections and they had a good effect.

Plague Committee's scheme.

389. In the beginning of April, the Plague Committee drafted a scheme for the medical inspection of all persons entering Bombay.

Inspection of Traffic.

390. The inspection of all passengers leaving Bombay by sea commenced on the 6th of February, and the inspection of the inward sea traffic commenced on the 12th of April, but from the beginning all passengers for Europe, Red Sea, &c., were examined.

391. Five observation camps were opened, to which 4,500 people were sent.

392. The inspection of passengers was most carefully conducted.

393. The native craft were examined at three different anchorages, and the steamers were examined at the wharves.

394. The inspection of the smaller craft had to be carried out with judgment, as many of them carried vegetables from across the harbour to the market.

395. In detaining passengers for observation, it was necessary to adopt different measures according to the degree of infection of the ports from which the passengers came. Passengers who came from Colaba were kept for 5 days under observation, and passengers from Kutch Mandvi were detained for eight days, as bubonic plague was prevalent at both these ports.

396. The number of persons inspected was very large—for April 106,272, for May 123,812. The numbers inspected show what a great task the inspection of the traffic towards this city is.

397. It was a most disagreeable duty, but it was carefully done. To Surgeon-Major Macartie great credit is due for the organization of the Harbour inspection, and to him and to Doctor Crimmin for the careful and vigilant performance of the duty.

398. In April there was considerable apprehension in consequence of the immigration of destitute people into the city. I wrote a report to the Plague Committee, recommending that all destitute people should be detained as soon as they approached the city and kept under observation, for it seemed to me better to feed them before they became ill, than to wait till they became ill and then treat them.

399. We had a telephone connection put up with the low-caste cemetery, Worli, as there was a great probability of interruption in the disposal of the dead.

The telephone was of great service during the epidemic. If there had not been a connection with the Arthur Road Hospital when the hospital was attacked by a mob, it would probably have been wrecked. As it was, we telephoned to the Police and the Police came at once in force.

400. For Europeans, the St. George's Hospital was opened to admit cases in September.

401. On the 13th of October a petition was sent to the Municipal Commissioner expressing the anguish felt on removal to hospital and how the measure was regarded.

402. In October, private hospitals were opened in Mandvi and Bhuleshwar for the reception of Hindu patients, but they had to be closed owing to the high mortality and the alarm caused by the presence of hospitals in crowded parts of the city. The hospitals were in charge of medical men selected by the Hindu community.

403. On the 4th of December, the Municipal Commissioner agreed to the erection of a temporary hospital by the Jain community in the Arthur Road Hospital garden. In addition to the hospital, a small shed was put up for the accommodation of the relatives or friends of the patients. The hospital afforded accommodation for 30 patients.

- The Farsi Hospital. 404. In the middle of December, Dr. Bahadurji opened an hospital in Parel to the north of the Technical Institute for the Parsi community. An objection was raised to the position of this hospital by people living in the neighbourhood.
- Reluctance of the people to enter hospitals. 405. Private hospitals were not largely opened during the commencement of the epidemic owing to the reluctance of the people to enter hospitals till the sweep of the epidemic was over. Even hospitals in positions so close to the city as the vacant ground to the north of the Victoria Gardens were unpopular, owing to their distance from the residences or the places where the people lived or where they were in the habit of frequenting.
- The Mussalman Hospital. 406. A Mussalman Hospital, as well placed as an hospital could be, was too far off to be popular, and another hospital for the same community was opened in a building in a most crowded part of the city. From the list appended it will be seen that 28 private hospitals were approved by the Plague Committee. They served so far a useful purpose, but the crisis had long passed. It must be admitted that in these hospitals there was not, and there could not be, any real segregation of the sick, as friends were admitted and came and went as they liked. Once private hospitals attempt to place restrictions on the movements of patients or their friends, they become as unpopular as public hospitals.
- Private hospitals and the Plague Committee. Segregation of the sick in private hospitals. 407. There is not, I apprehend, an hospital, public or private, in Bombay, which would not be deserted by the menials and abhorred by the sick if the administration was enforced according to the exact teachings of science.
- Private hospitals in the centre of city. Their usefulness doubtful during the crisis. 408. It is doubtful whether private hospitals in crowded portions of the city could have been made use of in the early days during the most intense period of the epidemic, and the most intense period of the panic, owing to the alarm that would have been caused through them. If cases had occurred around these hospitals in the beginning after they had been opened, they would have had to be closed. I have already referred to the alarm created by the opening of two private hospitals during an early period of the epidemic. As a proof of the unpopularity and the distrust of hospitals and medical treatment, I need only call attention to the attack on the Arthur Road Hospital in October, after which the hospital was protected by a Police Guard.
- Distrust of hospitals and medical treatment by the people. Attack on Arthur Road Hospital. 409. On the 11th of December, the Municipal Commissioner attended a meeting of influential men of various communities with a view to persuade them to erect segregation hospitals of their own in suitable position.
- Municipal Commissioner. Meeting to persuade people. 410. The *Times of India* criticizes the meeting as follows :—  
Provided the ignorant public be duly impressed by calm representations on that head, all, all will go well, and that segregation may be erased from the dictionary. But supposing the people decline to take patients even to caste hospitals, when calmly asked to carry them there, what then ?
- Press opinion. 411. In December, the Tramway Company wished to erect a small hospital, although only two cases had occurred among the staff.
- Tramway Co.



412. On the 15th of December, the Port Trustees commenced the erection of a temporary hospital at Santa Cruz. The position of the Port Trust Hospital was strongly objected to.

413. The extracts printed hereafter from a letter from the Presiding Elder of a Church will give an idea of how the opening of hospitals was regarded by neighbours in close proximity to them. The hospital was beautifully situated on perfectly open ground, 100 feet away from any dwelling :—

The location is on the edge of two populous districts, to both of which the proposed hospital must be a standing menace, far more dangerous than an occasional outbreak in the locality, which could be easily stamped out and the local confidence restored.

If the principle of segregation is to be applied, then this hospital should be removed, as far as possible, from public buildings, crowded thoroughfares, and populous districts.

Surely a more isolated location can be found than the one selected, which, if allowed to be so occupied, will be an embarrassing precedent for other communities who may wish to prevent or avoid proper segregation.

The alleged difficulty in removing cases to a locality beyond Mazagon, say, near the Powder Works, would not be greater than the difficulty in removing them to the Municipal Hospital at Arthur Road.

Finally I would point out that a whole community has been thrown into a state of alarm needlessly, as no cases have yet appeared among the class for whom this hospital is proposed; while every interest of security and contentment among them could have been gained by locating their hospital elsewhere.

413a. A meeting of the Mussalman community was held on the 20th of December and opinions not only opposed to segregation, but opposed to flight were expressed: "The Masjid is our hospital, and from God we have help." That was undoubtedly their feeling.

414. According to the inculcation, "If pest break out in a land, go not thither; if thou art there, flee not from it." This is a noble feeling—a feeling not to fly from danger that has animated Englishmen and others in this city. It is a right feeling to animate men.

415. The attitude of the Mussalman was at once manful, and from one point of view consistent and self-respectful. "We do not fear the disease, and we will neither run away from it, nor allow you to take us away." So they said, and yet the poor Mussulman gave us less trouble than many other classes.

416. In the opening of private hospitals we received assistance that was as timely as it was useful at that period of excitement from Sirdar Omer Jamall and Mr. Badrudin Abdulla Kur. It is owing to the Sirdar's assistance that the Julai Hospitals were opened, and Mr. Badrudin Abdulla Kur gave assistance in the organization of the three other hospitals.

417. The Principal of the Victoria Jubilee Technical Institute sent in a protest against the opening of Parsi and Hindu Hospitals in that locality. In fact, outside the hospital compound and the Municipal Office, there was not a single position that was not objected to by some one. We offered every community positions on the open land near the Municipal Hospital.

- Northbrook Garden awnings and sheds. 418. On the 26th of December I suggested to the Commissioner that open sheds should be erected in the Northbrook Garden for the accommodation of those who might leave their homes, or be turned out of their houses.
- Hospitals for Servants. 419. Towards the end of December, Clubs began to make arrangements for the accommodation of servants.
- Narelwadi Hospital. 420. In December, the Health Department commenced the erection of a temporary hospital and refuge behind Narelwadi in the Mazagon Section. Close to this hospital, at a subsequent period, the Plague Committee erected the Narelwadi Hospital.
- Northbrook Garden Camps (2). 421. In the last week of December, the Commissioner sanctioned the erection of two camps—one in the Northbrook Garden, and the other to the north of the Victoria Gardens.
- Treatment of servants. 422. At this time I also impressed on people with large gardens, that servants ill from the disease could be isolated in temporary sheds or hospitals in the gardens, and many people admirably arranged for the isolation and treatment of their own servants.
- Grant Road Hospital 423. The Commissioner approved of the opening of the second Municipal Hospital at Grant Road. It is a permanent Infectious Diseases Hospital, which has been constructed on the same principle as the hospital at Arthur Road, and has been used for many years for the treatment of infectious diseases. There is accommodation for 70 patients. This hospital would have been used long before, as it was ready, but that it was felt to be very much better to remove patients to the more open position where Arthur Road Hospital is situated.
424. In the beginning of January, Dr. Miss Benson came forward with an offer of assistance in nursing. The scheme embodied the following recommendations :—The employment of a lady doctor and the employment of a staff of nurses. I was greatly indebted to Dr. Benson for the assistance she proffered. The Lady Superioress of the "All Saints" Society nobly consented to take charge of the nursing in the Arthur Road Hospital.
- Hospital for Hotel servants. 425. In the beginning of January, the Hotels began to make arrangements.
- Halalkhors treated in their own buildings. 426. In January, we made arrangements to treat any halalkhor living in the halalkhor barracks ill from bubonic plague, in rooms at one end of the building. We also put up 20 huts on vacant ground, so as to relieve the overcrowding in the halalkhor chawls for our halalkhors to live in.
- Question of segregating a case in the Byculla prison. 427. A very important question was raised by Surgeon-Lieutenant-Colonel Waters in January. On the 26th of January he wrote to me that a suspicious case had occurred in the House of Correction, and inquired whether, in the event of the symptoms developing into plague, I would object to the patient being segregated in the compound of the prison.
428. In the beginning of February, Government having placed Government House, Parel, and grounds at the disposal of the Commissioner, the Commissioner decided to form a segregation camp for healthy persons, and one of our Inspectors and some others went to reside in Government House.

429. On the 10th of February Government issued a notification, empowering the Municipal Commissioner to take measures to prevent the spread of Bubonic Plague. Government notification of measure to prevent the spread of Bubonic Plague.

430. The notification specified the measures in regard to—

- (1) Dealing with buildings unfit for human habitation.
- (2) Overcrowding of buildings so as to endanger health.
- (3) Vacation of buildings for cleansing or disinfection.
- (4) Deserted or locked up buildings.
- (5) Power of dealing with buildings and articles found therein.
- (6) Cleansing and disinfection, which included the removal of earth or soil of floors and the whole or part of the roofs of buildings.
- (7) Compensation for damage caused by destruction or disinfection.
- (8) Cutting-off of water connections inside buildings where injury to health was apprehended, and provision of other means of water-supply outside such buildings.
- (9) Demolition of buildings unfit for human habitation and procedure to be followed in ascertaining value and the compensation to be paid to owners.

431. Proposals were now made to open hospitals in thickly-populated localities, but the opposition to the proposals on the part of the people living near the buildings selected for hospitals was very strong, because they had not in these localities suffered much, nor lost many of the population from the disease. These proposals were afterwards approved by the Plague Committee. Proposals for more hospitals.

432. On the 28th of February I informed the Commissioner that I was ready to open at once the Grant Road Hospital, and that I had arranged with the Sisters of the Cross of St. Joseph's Convent in Bandora, who had nobly volunteered and come to our assistance, to take charge of the nursing. Four Sisters were ready at once for duty and were content with any accommodation in beginning their duties. Grant Road Hospital opened.

433. I wrote to the Commissioner and arranged with the Sisters to administer the hospital. Dr. Dallas was to have been placed in medical charge of the hospital,

434. The following letter that I wrote to the First Physician of the J. J. Hospital will show how difficult it is to obtain information :—

It is impossible to trace in many cases the residences of patients from the meagre particulars given in the daily returns from the hospital, and, when the Health Department Sub-Inspectors go to the hospital, they are informed by the clerk that further information cannot be obtained. In consequence of this, many cases cannot be traced, and residences

cannot be visited, and sanitary precautions taken. I have to request that you will kindly direct that when patients are brought to the hospital, full particulars shall be obtained of their residences.

435. The reply was as follows :—

It was absolutely correct that many of the patients are in such a feeble state that they are unable to give information as to their residences, and a large majority of our hospital patients are from a very poor and ill-informed class, who have not the slightest idea of locality, and cannot indicate whereabouts they live beyond saying "Mazagon," "Kamathipura," for instance, although they can find their own way; that is about all they can do.

Municipal Hospital,  
Arthur Road,

436. The Infectious Diseases Hospital at Arthur Road was the Municipal Hospital, to which all cases were removed in the beginning. It was ready to receive cases throughout the year. The three first plague cases were sent by me to it.

437. The hospital buildings are open sheds, and the authorities from different parts of the world, who have seen them, are of opinion that the buildings could not be better adapted for the treatment of infectious diseases. The best proof is that the results of treatment in this hospital have been excellent. Around the hospital there are 27,393 square yards of open ground for the hospital, besides other open space and accommodation can easily be erected for any probable number of patients. I purchased the ground for this hospital as far back as 1875, and the hospital has been in use since 1882.

438. There was the same opposition to the opening of this hospital that there has been to the purchase of sites in other positions in the City for hospitals for the treatment of infectious diseases.

Harbour Hospital,

439. On the 2nd of March, it was proposed to open a segregation hospital for the detention of suspicious cases detected on board steamers or other craft in the harbour. I selected a site on the Mody Bay Reclamation near the Servants' Hospital. The Trustees agreed to the use of this position. The Plague Committee afterwards erected an hospital on it.

Prohibition of  
departure of pil-  
grims for the Hedjaz,

440. In view of the strong opinion expressed by all European Governments regarding the danger of the plague being carried to Europe by pilgrims, the Government of India issued an order in February 1897 prohibiting the pilgrimage from India. This drastic measure was taken because it was believed that nothing short of entire prohibition would ensure protection.

Closing of hospitals.

441. On the 16th of June the Chairman of the Plague Committee wrote to Government :—

As the temporary plague hospitals have all been closed owing to the monsoon, and Arthur Road, Grant Road and Parel Hospitals contained only a few acute cases in each, the Plague Committee has decided to close Grant Road Hospital, to gradually clear Parel Hospital as convalescents are discharged, and to concentrate all plague cases at Arthur Road Hospital, at which place also future convalescent cases will be retained.

First Dispensary.

442. In the last week of September a small Municipal Dispensary was opened in Mandvi, and Dr. Dallas was placed in charge of it.

442. In the beginning of March, I opened the second Municipal Dispensary Second Dispensary. and placed it under Dr. Ranina, who had already from the beginning been in charge of Mandvi and Dongri. The difficulty was to persuade people to take medicine as they had lost all confidence in treatment. Dr. Ranina had, however, already secured the confidence of many in these districts through the influence of success in treatment. This was the first step towards giving medical relief to the poor at their homes.

443. From some medical men I received very kind offers of help. One Offers of help from medical men. wrote to me :—

I may inform you that, if you wish to make use of my dispensary for your temporary office work for giving instructions to your servants, my rooms are quite at your disposal.

444. To show the variety of work we had to do, I may state that we put up Erecting segregation sheds for servants by the Health Department. in two days segregation sheds for servants who lived in a horse stable behind a range of buildings in Byculla. At this place, to our surprise, we observed that even Europeans permitted their cooks to attend on sick relatives living near the cook-rooms. The Engineer whom we had asked to put up the sheds naturally Asking the Engineer to erect sheds. enquired whether the permission of the owner of the property had been obtained, and I replied that it would take too long to find the owner. Ten rooms were put up. Surgeon-Lieut.-Col. Kirtikar gave us assistance here.

445. On the 19th of February, the Commissioner wrote a memorandum to guide us in the matter of the erection of huts or sheds :

In future the work of putting up huts and sheds in the various parts of the island, where Erection of huts and sheds to be carried out by the Executive Engineer. they may be required, must be carried out exclusively by the Executive Engineer, as it is important to secure suitable and durable patterns of such buildings.

446. We thought nothing at the time of putting up huts and sheds for servants, or for the homeless from different parts of the island.

447. On the 24th of February, and not till then, the first case occurred in a First case in a shed on the Flats occupied by scavengers. shed put up on the Flats for the scavengers working on the reclamation. We erected at once another shed on the reclamation.

448. On the 25th of February, the Church Missionary Society asked per- The Church Missionary Society ask permission to erect huts in the Church compound. mission to erect huts in the Church compound for their servants in case that bubonic plague again appeared amongst them, as cases had occurred before ; and the places where the people had been segregated had been burnt down.

449. A Doctor writes, suspecting a case of bubonic plague :— Doctor's difficulties.

Last night I learnt that my *hawal* bolted with his wife in the direction of Mahim.

This indicates the difficulties masters had, even though the master was a Doctor, and the difficulties we had too.

450. The medical men at stations had very unpleasant experiences in the Experience at the Railway Station. beginning. One of them wrote to us :—

I would not have troubled you were it not for the insolence and impertinence displayed by \* \* \* when asked to detain a very suspicious case last night.

In this case the passenger's temperature was 103·8, pulse thready and feeble, being 110 per minute, eyeballs congested, and the tongue was thickly coated with a brownish white fur. On enquiry, the passenger further stated that he was in this condition for some time and was not being treated by any Doctor, and therefore I thought it right to detain him \* \* \*.

He was openly pitying and sympathising with the passenger, so that the people around were excited over the matter.

451. This is one of the pitiful appeals I received :—

Pitiful appeal. . . . I beg most respectfully to inform you that about 11 o'clock this morning, when I was absent from my house, my daughter about the age of 25 years (who gets sometimes a similar sickness to plague, and from which she is suffering from just now, but gets cured within five or six days after taking country medicines) was removed forcibly together with her son who is about five years age, by a Parsi who came to my house in my absence. My neighbours told the Parsi that she was not suffering from contagious disease, which is now prevalent in Bombay, so do not remove her, or at least wait until her father comes. He did not listen to anything, but at once removed her. If anything more is done to this girl and child, I will hold the Municipality responsible for her life, if not, please give orders at once to give back my daughter and her child.

Application for reward. 452. One man sent us an application for a "prize of Rs. 10" for reporting cases of bubonic plague,

A case of ill-treatment. 453. There were not many cases of ill-treatment of the sick, but one case came to our notice, and that was the case of a Tramway Conductor. He left his own house and went and lay down in the verandah of a shop. In the morning he was thrown out on the road where we found him.

Private advice and remedies. 454. We had much advice about the treatment and many offers of medicine.

455. In October we had a letter stating that a certain person had "means, by virtue of which he can relieve the public of the so fiercely prevalent disease in the City of Bombay in course of sixteen days." Even from distant places we had offers. One man wrote :—

I am a *sadhu* physician. I learnt some of my medical art from a venerable *jogi*.

Then honestly he writes in regard to the treatment :—

I have not ever tried these pills, but my respected teacher told me that he successfully experimented on this very disease, and, though he informs us, I knew the chief cause from which the disease springs.

Another more competent wrote :

I have succeeded in finding a cure.

Curious suggestions. 456. In the beginning, people were more confident of cure. One man wrote to us that he had a cure not only for plague, but for hydrophobia, murrain, pneumonia and anthrax. We received many suggestions, some of which were very curious. One writes : "Remove the nasty sewers, and, to be sure, the plague will disappear." He also tells us to inform the Chairman of the Corporation of the advice he has given.

457. Another writes : " The chief cause of the plague is, in my humble opinion, as well as in the opinions of the people in general, that bad drainage, and chiefly the smell enters the house which has no remedy in the hands of the people to put a stop to, is the cause of the plague." He also suggested that the drains should be stopped for a day or two so as to allow germicides to be put in. He also called upon us to disconnect the houses from new drains without loss of time.

458. Here are words with a brave ring :—

" We have purposely refrained from mentioning the subject, because we were not desirous of adding to the panic which, unfortunately, has seized the public mind ; however, it serves little purpose adopting an ostrich-like policy, and let us at once admit that the position of affairs is grave. But grave as it is, there is no reason for abject fear. Bombay at the present time is abnormally unhealthy, and one of the diseases which is adding to the high death-rate is bubonic fever. As sensible men, it is for us to face the situation, and not, as so many of our citizens are doing, to run away and thus leave our beautiful city to the plague-stricken and the poor." Panic and flight censured.

459. The lighting of fires in the streets was suggested to us ; we had fires in the houses to disinfect and dry them after they had been flushed out. Huge bonfires were recommended and some people lit fires in the streets, and a great comfort in the cold season they were to many poor people. Remedies suggested—Fires.

460. Many people objected to sulphur—the " nasty sulphur " as it was called. Others were very businesslike. One wrote to us : " I beg to request what reward and pay I shall get if the preparation is shown by me." Sulphur.

461. The burning of horses' manure was suggested amongst other remedies. Manure.

462. The burning of lime-stone in the streets was strongly recommended. Lime-stone.

463. Some were very modest, and would commence in this way. " In time of need, advice indeed acceptable from many sources" but as they went on, they became more confident, and would guarantee that the weekly death-rate of the city would be reduced by more than one-half, and they would often tell us that they were not the inventor of any patent specific that warranted to cure every malady. One *Hukim* undertook to root out the disease. He also wrote : " If God helps me in curing the Plague cases, what a great blessing will be to your honour." Curious remedies.

464. One gentleman offered to supply a cure on advantageous rates. Another guaranteed to stamp the plague out in 25 days. Another seller of medicines asked us to try his medicines. He assured us that the plague microbes are killed immediately, and, to do so, all that was necessary was to " fill up the system with ague mixture." This well-meaning seller of patent medicines lived in a district where bubonic plague did not come for some time. At last it came close to his house and he ran away and left his fever mixture behind—the wisest thing he could have done. Another guaranteed to cure every case in 4 hours. Some of these charlatans affected much grief and one wrote, " that not being able to bear the sight of so many dying every day, I beg leave to make my remedy" Patent medicines and Doctors.

"known to you, because most deaths to thousand now-a-days." Some of these remedies consisted in applying *medicines* to the "conjunctiva."

465. Charlatans from all parts of the world seemed to hover round us like birds of prey.

Even from Europe one unknown telegraphed that a certain preventive was the excellent and old remedy, of salt and water. Salt is an excellent alterative.

466. Sometimes they interspersed a little flattery and wrote of our great efforts.

467. One wrote to us that "all we had to do was to distribute quantities of Epsom salts," but the writer complemented it in his treatment by putting the patient on a boiler!

Curious letters.

468. One wrote to us in this curious strain: "I, after entreating you to make acceptable my duty of being a human race," and after this he told us that he had "an oil which would kill the disease."

469. Another distinguished *Pandit* commenced by telling us that Bombay is "a crown to India." He wrote: "I shall try to prepare a cure out of rare and valuable drugs and medicines that I have at hand."

470. Another practitioner wrote to us: "I am strongly of opinion that this plague is not a new one for India," and he then proceeded to describe correctly the epidemics in the Himalayas: "My parents," he proceeded, "then prepared a medicine from indigenous drugs. The result was that it came as God like a good angel and cured most of them."

471. From curious letters received, I may quote the following in regard to a house, the rent of which was about Rs. 100 a month: "and has got no heir to enjoy the income except only a widow, and hence no expense should be made by the Municipality to give comfort to the poor tenants."

Curious Remedies.

472. Among other remedies recommended to us, was a pill made of pigeon's dung.

473. One person sent us a specific called the "Fume-destroying elephant-like disease."

A plague specific.

474. One of the vendors of the plague-destroyers certifies his powder to have marvellous qualities. "This is in the form of disinfecting powder, odorous, and when burnt, the smoke is potent to check the plague by destroying all the germs of the dire disease."

Houses locked up.

475. One of our troubles was in dealing with buildings where the rooms were locked up. The landlord wrote to us:—

Your department people, I am informed by my Rent Collector, have begun to clean and whitewash the rooms in which deaths had occurred. But not satisfied with this, they want the other rooms, which are kept locked up by the tenants who have gone somewhere to be given over in their charge by breaking open the locks and removing all the contents of the rooms for the purpose of their being also cleaned.



476. Our systematic lime-washing was very much resented by some owners of property. One very wealthy landlord wrote to us :—

As there is no sickness of any kind among the tenants residing in the said house, nor any of them attacked with pestilence, I fail to see the necessity for the Health Department taking such arbitrary steps.

477. Another wrote to us in February after lime-washing had commenced on a large scale in the Fort :—

I am not a little surprised at the conduct of your workmen, bigarees, bricklayers and whitewashers. Early this morning they commenced without my knowledge to erect bamboo scaffolding in the front of our house, numbered 111 and 113 in Bora Bazaar Street within the Fort. When I came to know of it, I expressly forbade their doing so, on the grounds that the said house was whitewashed, repaired and cleaned a fortnight back, and that in its present state it is not offensive to the public health.

478. The cutting off of the water connections inside buildings caused great dissatisfaction as it caused great inconvenience. One wrote to us :—

Owing to your men having cut off the water connection and also commenced disinfecting operations, all the tenants were naturally frightened, and nearly seven-eighths of them have vacated.

Another writes to us :—

I am surprised to know that, even though I have strong proof of the whitewashing of the property, your men, assisted by the Police, forcibly entered the houses and commenced to whitewash, which was unnecessary and a *Zoolum*.

I now come to refer to the results of the labours of the Scientific Commissions who came here to study the disease, and in doing so, I must express my obligations to the members of all the missions for the advice that on all occasions they most frankly and generously gave me. I would specially mention the obligations I am under to the members of the Mission from Germany, two of whom, Dr. Gaffky and Dr. Pfeifer, I had met before, and the members of the Egyptian Mission.

479. The extract printed hereafter from Dr. Bitter's report on his work in Bombay is of great interest. His opinion which he communicated to me at the time on the simple glandular form of plague is of great practical interest and value. He writes :—

Neither in the sputum, nor in the urine, nor in the fecal matter, did I succeed in finding plague bacilli, although the examinations were not very numerous, I am certain they ought always to be negative.

As long as the bubo is active, the plague bacilli are usually found in the pulp in quite large quantities. By extracting a small drop of lymph by means of a Pravacz syringe, or an exploring lancet, and by making of this liquid a microscopical coloured preparation, the presence of bacilli rarely fails to be proved. In every case a part of the small drop shown on a gelatine tube after a 30-hours culture gives a positive result.

*If the gland suppurates, the bacilli appear to die quite quickly.* Most of the specimens of pus from cut bubos that I examined were either sterile, or contained only some pyogenous microbes. Still, in some rare cases, I have found plague bacilli in the pus, but in small quantities. Although in that case the bubos were opened early, they showed inside little pus and a great deal of solid glandular tissue.

In this tissue, the bacilli were found in larger quantities than in the pus.

*In every case of plague, followed by recovery, I could not prove specific bacilli in the blood of the patient, even though I have examined (as regards this point) a large number of patients at all stages of the disease.*

It will not be superfluous to add here some details of the method employed to find bacilli in the blood.

*It is absolutely impossible to arrive at conclusive results, while one has to be content to work with coloured microscopic preparations. Even in cases where the blood contains bacilli in considerable quantities, their presence is only proved with difficulty by the microscope alone. On the other hand, in their absence, one is easily deceived by various coloured fragments or bacilli proceeding from the skin, etc. In order to be certain it is always necessary to have recourse to culture by exposing one or more drops of blood on a sloping gelatine surface.*

Professor Gaffky (who made many experiments in this way and was always most willing to tell me the results) was of the same opinion. Besides blood, I have, at different times, examined the *excretae* of patients suffering from the simple bubonic form. *Neither in the sputum nor in the urine, nor in the fecal matter, did I succeed in finding plague bacilli.* Although these examinations were not very numerous, and I am certain they ought always to be negative, whereas the specific bacillus never circulates in the blood.

In some cases it happens that the organism succeeds in subduing the bacilli in the bubos, but it succumbs in the end to the attacks of some pyogenous microbes that have entered the bubo. Usually these microbes only cause local suppuration, but under certain conditions they invade the organism and cause either numerous abscesses or fatal pyæmia. It follows that the pyogenous microbes find a more favourable field for their development in an organism weakened by the attacks of the plague bacillus. We make the same observations in other infectious diseases. I have noticed many cases of the kind in autopsies. Some observations that I have had occasion to make on the skin boils (anthrax) that are found everywhere amongst the plague-stricken has given me the opinion that these ulcerations owe their origin either to infection by pyogenous microbes or at least to a mixed infection of the latter and plague bacilli. I have not been able to find in them plague bacilli.

Dr. Wilm's report  
on Hongkong.

480. Wilm believed that flies were to be suspected as carriers of the disease.

The experience obtained in Hongkong in regard to the influence of the state of the atmosphere on the spread of the disease is very much the same in India, and that is that the disease thrives better in a damp, moderately cool, still atmosphere.

Season periods.

481. In Hongkong, in 1894-96, the epidemic broke out at the end of the cool season and reached its height in the early months of the hot season.

The carriers of con-  
tagion.

482. Wilm classifies the carriers of the contagion as follows :—

Man (first); cloth-  
ing (second);  
animals (third).

As carriers of the contagion we must, in the first place, mention men themselves suffering from plague; next, pieces of clothing contaminated by the faeces, urine or expectoration of patients suffering from plague; and finally, such animals as mice, rats, pigs, &c., coming from plague-infected districts.

Clothing—transport  
of disease.

483. It has not been definitely ascertained, nor can it well ever be, by what means the bubonic plague was brought into Hongkong. Wilm makes a very important statement in regard to the transport of the disease by clothing.

He states that when sterilized pieces of linen were soaked in bouillon culture of the plague bacillus and then preserved in porcelain capsules, cultures on agar plates could still be made from them after the lapse of four weeks.

484. In Hongkong, as in Bombay, the bacilli find the most suitable soil in dark and damp buildings.

485. Wilm took the view that the bacillus enters the body most frequently by way of the alimentary tract. This does not seem to be supported by experience in Bombay, for, if it was so, a larger number of Europeans, who use more uncooked food than the people who were most generally attacked, would have been affected. Moreover, most of the people who suffered from the disease belong to classes who used very little uncooked food.

Dr. Wilm's opinion of how the bacillus most frequently enters the body.

486. In regard to the prophylaxis, Wilm was of opinion that the most successful prophylactic measure is to prevent the importation of the contagion. This can only be effected by stringent supervision of intercourse.

Prophylactic measures.

487. In referring to the burning of infected articles, he makes a very important recommendation which confirms the procedure I adopted here against much opposition in the burning of articles that came in contact with persons suffering from the disease. He writes: "In this connection, care should be taken not to carry the articles to be burnt to any considerable distance, for to do so may lead to the dissemination of the plague." This recommendation is very important and, however much the burning of articles close to the infected house may be objected to, it should be carried out.

Burning of infected articles.

488. Wilm also recommends a procedure I adopted, and which caused a great deal of dissatisfaction. He writes: "If plague breaks out in a house in which articles of food and drink are for sale, the shop must be closed." This was the procedure adopted in Bombay from the very beginning. We adopted here a system of burning outside buildings in which cases of bubonic plague occurred sulphur fires. This system was very much misunderstood. The object was to inform us whether a case had occurred, and it was a most useful and simple way of warning people not to go there. Wilm writes: "Houses that are known or suspected to contain cases of plague should not be visited."

Sulphur fires.

Dr. Wilm's remarks.

489. In Hongkong it was observed that "diarrhoea was frequent at the outset and again in the latter stage of the disease." This has been observed here.

490. Our experience of the type of disease here has not always corresponded with the experience in other places; for instance, in Hongkong "at first, during the height of the epidemic, the cases were for the most part very speedily fatal. \* \* \*" "Besides these severe cases of plague, slighter cases were also met with, which were specially frequent towards the end of the epidemic," while I have seen some of the most severe cases at the end of the epidemic. The type of the disease did not so much seem to change as the predisposition to it and power of resistance.

491. The results of the examination of the blood by Wilm are interesting. He found in 20 per cent. of the cases staphylococci. The results of his examination of the blood of punctured buboes does not correspond with what I have seen here. He states: "In the blood from punctured buboes, the presence of the plague bacillus could always be demonstrated by microscopical and bacteriological examination." In the saliva the bacillus was found in 14 out of 18 patients suffering from plague. In the vomit, the presence of the bacillus was demonstrated in 18 out of 20 cases examined.

492. The results of the work of the Russian Plague Commission published in a paper read before the Bombay Medical and Physical Society are of much interest.

493. Of 24 *post-mortems* made, seven had buboes on the left side, two on the right side and one on both sides. They write: "No other gland or organ ever contains such a large number of bacteria as the primary buboes."

Russian Plague  
Commission results.

494. In regard to the pneumonic variety of plague they write: "Our attention to the study of pneumonia was directed by the valuable communication of Professor Childe of the Grant Medical College and from our investigation we are prepared to state, that plague-pneumonia occurs in two forms, that is, primary and secondary. \* \* \* " In plague-pneumonia, both primary and secondary, we find great quantities of plague-bacteria in pure cultures or in combination with the pneumonia is diplococci of Fraenkel, or with streptococci. The plague-pneumonia is characterised by nodules of infiltration of a mucoid aspect. Clinically it is often distinguished by an entire absence of cough and sputum."

495. They describe the mucous membrane, as I have frequently seen it injected, aerated and covered sometimes with blood. They also state: "Never have we observed the bacilli in the blood before death." They had not seen any cases of primary infection by the stomach. They also were of opinion "that the plague was produced in monkeys in all cases by infection." I, however, saw two monkeys that had been killed by an emulsion of bacilli injected into the stomach, by the German Scientific Commission and the post-mortem appearances were most characteristic in the intestinal manifestations and hemorrhages.

496. The result of experiments made by the Russian Commission to ascertain whether infection through the skin can take place without leaving any lesions at the points of inoculation are very interesting. They write: "From our experiment we are convinced that the plague is produced in monkeys in all cases by infection. The result of experiments is very interesting because it does not leave any doubt on this point, as in man the infection by the skin can develop without producing any lesion apparent at the point of inoculation of the virus."

497. They also find "that it is possible to infect monkeys by the channel of respiration, by introducing plague cultures into the trachea by means of a tube during chloroform-narcosis. They die within two to four days, presenting the signs of typical plague-pneumonia."

498. Their observations on the agglutinating power of the blood of the plague-stricken are very interesting. They write: "This power manifests itself only towards the end of the seventh day of the malady, increases in the second, third and fourth week, and then diminishes."

499. The knowledge we have gained shows that the negative results obtained in the beginning by Dr. Dutt in blood taken from the finger tips were correct.

500. It appeared to me that in many of the cases the sudden approach of death, due to failure of the heart's action, was hastened, if not caused, through insufficient vitality from living in overcrowded houses and rooms. Failure of the Heart.

501. A very interesting case, more interesting as the only one amongst the Scientific men who came here to study the Pestilence, was that of Dr. Sticker, a member of the German Scientific Mission. A copy of the case has been kindly sent to me by Dr. Boyd. Dr. Sticker was inoculated on the hand during a *post-mortem* examination. Case of Dr. Sticker.

The Professor was admitted into hospital for a poisoned wound of hand on Saturday evening, when doing a *post-mortem*, he accidentally punctured the right thumb. On Monday he experienced pain in the wound and up the arm when fever came on. On the following morning (Tuesday) a vesicle appeared and from its serum plague bacilli were grown. On admission, a young man in a well-nourished condition. Face somewhat flushed, drowsy aspect, tongue furred, complains of pain in right forearm. On examination, there is an irritable-looking vesicle on outer aspect of right thumb at meta-carpo-phalangeal-joint, with redness and swelling extending up the forearm to elbow-joint, the lymphatics being thickened to the entire length. The arm is very painful. Temperature on admission 99·2. The temperature yesterday reached 101·4; this morning normal; slept well; pain in arm much easier. Doing well. Afterwards discharged cured.

502. I may add to the notes, that Dr. Gaffky on finding plague bacilli at the point of inoculation at once inoculated the vesicle with perchloride of mercury and this inoculation probably saved Dr. Sticker. When the vesicle was first noticed there appeared to radiate from it two streams of enlarged lymphatics running up to the elbow-joint.

503. A very interesting report was made by Mr. Hankin, in February, on the vitality of the bubonic plague microbe in the chief grain exports from Bombay. The conclusions Mr. Hankin came to were as follows:— Mr. Hankin's experiments on the vitality of the microbe in grain.

*Para. 20.*—The remaining point of the enquiry is the resisting power of the microbe as it exists in secretions of the human patient. For this purpose I chose the sputum in which the microbe has been shown by Surg.-Captain Childe, Professor of Pathology in the Grant Medical College, to exist in large numbers and in a virulent condition.

*Para. 21.*—Sputum recently obtained from a patient was mixed with an equal volume of bouillon. One cubic centimetre of the mixture was immediately added as before, to each of the specimens of grain. Owing to an accident, the linseed could not be used in this experiment.

Experiments on mice

*Para. 24.* Four days after the commencement of the experiment, extracts were again injected as follows :—

- Mouse treated with extract of yellow rapeseed survived.
- Mouse treated with extract of brown rapeseed died within 24 hours.
- Mouse treated with extract of tilseed survived.
- Mouse treated with extract of groundnuts survived.
- Mouse treated with extract of poppyseed survived.
- Mouse treated with extract of wheat died within 48 hours.
- Mouse treated with extract of flour died within 48 hours.

*Para. 25.*—Six days after the commencement of the experiment, extracts were made and injected with the following results :—

- Mouse treated with yellow rapeseed survived.
- Mouse treated with extract of brown rapeseed survived.
- Mouse treated with extract of tilseed survived.
- Mouse treated with extract of groundnuts survived.
- Mouse treated with extract of poppyseed survived.
- Mouse treated with wheat survived.
- Mouse treated with extract flour died in three days.

Conclusions.

*Para. 23.*—In the experiments now described, by keeping the grain in a dry condition in bags, I imitated more closely the conditions that exist in commerce. Under such conditions the microbe of bubonic plague appears to die out within from four to six days. In a few instances, my experiments have suggested that it may survive for periods extending up to 13 days. But it must be remembered that my experiments had to be carried out with the aid of mice owing to the impossibility of obtaining a sufficient supply of healthy rats in Bombay at the present time. It is more probable that the death of the mice in these exceptional instances was due to the accidental presence of other microbes than that unusually resistant forms of the bubonic microbe were present.]

Mr. Hankin did not succeed in finding the microbe in grain. He writes:

The microbe not found in grain.

In reply to your enquiry as to whether I have ever found the bubonic plague microbe in grain and flour, I beg to state that, although I have examined a large number of specimens under different conditions, I have never succeeded in detecting it. My observations have been carried out on both clean and dirty grain sweepings of granaries under infected dwellings, grain mixed with rats' dejectæ taken from near the body of a dead rat, grain that had been carried by rats through a hole in the wall of a granary and stored in a latrine, but in all cases a negative result has been obtained. I have also examined weevils and other insects parasitic on stored grain without detecting the microbe. I have recently examined flour from a small godown in the Fort in which rats had been dying of the plague with a negative result.

Measures adopted supported by laboratory work.

504. The experiments in the laboratory now described confirm the opinion I had formed that within a definite time the disease seems to disappear from dwellings that have been vacated even though they have not been disinfected. I fixed the time at 20 days. The procedure approved by the Commissioner and carried out in closing godowns has been confirmed by the experiments of Mr. Hankin referred to.

505. The following is a very interesting paper by Mr. Hankin on the <sup>Action of disinfectants on the</sup> action of disinfectants on the bacillus of Plague. His experiments confirm many <sup>microbe</sup> of the conclusions we had arrived at practically:—

In accordance with your verbal request, I have the honor to send you a short resumé of my work on the action of disinfectants on the microbe of bubonic plague.

The microbe of plague appears to be somewhat resistant to the action of carbolic acid, as it is not destroyed by that substance, even after 20 minutes' action, in a half per cent. solution. Disinfection is not always produced even by one per cent. in the same time. On the other hand it appears to be destroyed both by phenyle and izal in a strength of 1 in 1,000. Neither of these substances, however, appear to me to be suitable for disinfection of houses, &c., on a large scale.

The microbe appears to be unharmed by naphtholine, whether pure or impure, and by naphthosublimite.

It is very readily killed by corrosive sublimate. This substance in an acid solution is, I believe, the safest disinfectant for houses on a large scale. The solution employed should contain one part per thousand of sublimate, and two parts per thousand of hydrochloric acid. I found by experiment that while such a solution is very efficient, a neutral solution of sublimate has scarcely any action on the microbes of a cowdung floor.

A solution containing 1 part per 1,000 of copper sulphate was found to destroy the bubonic microbe under the conditions of my experiment.

The plague microbe was found to be resistant to the action of alkalis. It is not destroyed by caustic potash in a solution of 1 per cent. or by ammonia containing 3 per cent. of the saturated watery solution. It is somewhat resistant to the action of quicklime. Water can only dissolve 0.13 per cent. of this substance, and in two out of six cases I found that the microbe was not destroyed by solutions to which more than this proportion had been added. It was found to be scarcely affected by lime that had been exposed for a few days to the action of the air.

The plague microbe was found to be extremely sensitive to the action of acids. The following are some of the results obtained:—

The plague microbe was found to be destroyed in five minutes under the conditions of my experiments by

Formic acid in a strength of	1 in 100
Acetic acid do.	1 in 142
Lactic acid do.	1 in 333
Nitric acid do.	1 in 333
Hydrochloric acid do.	1 in 500
Sulphuric acid do.	1 in 1,429

The great cheapness of sulphuric acid, the probability of its exerting a continued action, and its activity in destroying the bubonic microbe suggest that it might be used with advantage. A solution containing 1 part in 250 of water would probably be found sufficiently strong in most instances.

The sensitiveness of the bubonic microbe to the action of weak organic acids is of interest in view of the fact that our forefathers relied greatly on "aromatic vinegar" as a means of protection against the infection of plague. My experiments have some bearing on the probability of food stuffs or rotten grain or dead bodies acting as the nidus for the microbe, as all these substances either have or readily acquire an acid reaction owing to the development either of the acids that I have tested or of others closely allied.

The Bubonic Plague microbe was found to be very resistant to the action of reducing agents, and very sensitive to the action of oxidising agents such as permanganate of potassium or

chloride of lime. This fact is of interest in view of the asserted influence of ventilation in destroying the microbe of plague, as it is difficult to believe that ventilation acts otherwise than as an oxidising agent.

I have carried out a series of experiments on the disinfection of cowdung floors. It was found that the microbes present were not killed, but rather increased in numbers when the floors were treated with the following solutions :—

Corrosive sublimate in a strength of	1	in	1,000
Chloride of lime	do.	1	in 100
Phenyle	do.	1	in 100
Lysol	do.	1	in 100

The only substance tested whose action on a cowdung floor appeared to be satisfactory was corrosive sublimate in a solution acidified with twice the quantity of hydrochloric acid. A fairly satisfactory action was exerted also by a solution containing one per cent. each of permanganate and sulphuric acid.

A separate series of experiments have been carried out on black stagnant mud, which may harbour offensive microbes. Probably the best disinfectant for this substance is a solution containing one per cent. each of permanganate and hydrochloric acid. Kronig and Paul, in an article on disinfectants published recently, recommend such a solution containing the same quantity of permanganate and half the above quantity of hydrochloric acid. They say that in its action on anthrax spores it is more energetic than a five per cent. solution of corrosive sublimate.

506. In December I wrote to the Commissioner in regard to the preparation of a prophylactic serum and the proposal to obtain the services of Dr. Yersin.

Recommendation of  
the Health Officer,  
Mons. Haffkine,  
Dr. Yersin.

I would venture to suggest that a more practical and expeditious course to obtain curative serum would be to give Professor Haffkine all the means he may suggest for the preparation and production of serum. I have not the slightest doubt that any results that may be expected from Dr. Yersin's treatment will be obtained from the serum being prepared by Professor Haffkine. So far the results of Professor Haffkine's experiments have been most encouraging. Any serum which may be prepared by Dr. Yersin will not be ready, I take it, for many months, and it seems to me that the most practical and therefore the best course is to give the utmost assistance to Mons. Haffkine that may be suggested or required by Professor Haffkine himself. In this matter I have, and I believe you share it, the most absolute confidence in Mons. Haffkine.

Prof. Haffkine's Pro-  
phylactic serum.

507. Professor Haffkine had been engaged in the preparation of a serum from the beginning of November. Twenty-one animals had been immunised and had acquired a high resisting power.

508. Mons. Haffkine wrote to me :—

As the preparation of an antitoxic serum is in its nature a cautious and long process, and as every individual animal can yield, without feeling the effect of it, only a limited amount of serum, I agree with the idea which you have expressed in your conversation with me, that it may be considered desirable, in the event of the attempt giving a positive result, to increase from the present, the stock of animals under treatment.

509. At Dr. B. S. Shroff's request prophylactic serum was supplied by Professor Haffkine and inoculation commenced in the suburbs in January.

Results of prophylac-  
tic treatment in the  
House of Correction.

510. The appearance of Bubonic Plague in the House of Correction gave an opportunity for trying the effect of the serum that could not have been obtained amongst the population in the city. The statement printed hereafter, which Brig.-Surg.-Lt.-Col. Waters has kindly supplied to me, shows the results of Professor Haffkine's prophylactic treatment in the House of Correction.



511. The statement is most interesting and indicates conclusively the prophylactic influence of the treatment. The results although on a large scale correspond in their accuracy and completeness with a laboratory experiment. It will be observed that in one group of population of 173 prisoners who had not been inoculated there were twelve cases with six deaths. In another group of 148 prisoners who had been inoculated there were within the same period only two cases, none of which terminated fatally. I exclude entirely the results on the day of inoculation as immunity could not well be expected within the first 24 hours. The cases that occurred within the House of Correction are of the greatest interest. Here we have a population living under the same excellent sanitary conditions and under the same regulations within buildings in a space more beautifully clean than can be found in city life anywhere, suffering as the people in many of the most crowded portions of the City. There is a probable explanation which I may hereafter offer, for any explanation at this stage must be put forward not only with hesitation but ought to be accepted with caution. My belief in the efficacy of the prophylactic was based on the results of the experiments made on animals by Professor Haffkine and the immunity secured thereby and the similarity of the symptoms to the true disease. The results were more favorable than would have been expected in the beginning. For the opportunity that has been given of studying the effects of the prophylactic treatment we are under great obligations to Brigade-Surgeon-Lieutenant-Colonel Waters. I recommended that for the preparation of the prophylactic Professor Haffkine should receive the utmost assistance we could render and that a building should be rented in a central position in the densely populated city near the tramway, having accommodation for patients and for animals. A large building not only properly situated but with at least thirty rooms and an open space for stabling was I thought necessary.

*Statement showing the result of Professor Haffkine's prophylactic treatment against Bubonic Plague in H. M.'s House of Correction, Byculla, Bombay.*

Dates.					Non-inoculated.		Inoculated.	
					Attacks.	Total.	Attacks.	Total.
Day of Inoculation.	30th January 1897—	Before Inoculation ... ..	6	3	nil	nil		
		After do. ... ..	nil	nil	3*	3*		
From the day after Inoculation.	31st January 1897 ... ..	2	1	1	nil			
	1st February 1897 ... ..	1	1	nil	nil			
	2nd do. ... ..	1	1	nil	nil			
	3rd do. ... ..	...	...	...	...			
	4th do. ... ..	1	1	nil	nil			
	5th do. ... ..	2	1	nil	nil			
	6th do. ... ..	5	1	1	nil			
Total after the day of inoculation ... ..					12	6	2	nil
					In an average population of 173		In an average population of 148	

\* These three cases were undoubtedly infected with plague prior to Inoculation.

Dr. Herbert sums up the results of Mons. Haffkine's inoculations in the following words :—

Dr. Herbert's remarks  
on the serum.

511. The total number of inoculations in Bombay from January 10th to March 5th, 1897 has been 2,156, including 991 Parsis, 602 Hindus, 116 Mahomedans, 144 Native Christians, 13 Jews, and 290 Europeans. Excluding the three fatal cases in the House of Correction, who were attacked on the day of inoculation, there have been only four attacks and no deaths reported among the inoculated. The estimated plague mortality (see *Times of India*, March 5th) in Bombay from January 13th to March 2nd is 8,155. If the average population for this period be taken as 400,000 which seems, according to the *Times of India*, to be a fair estimate, this gives a plague mortality of two per cent. among the general population. Allowing for a slow gradual rise in the numbers operated upon, the average inoculated population for the period under discussion must be at least 700 or 800. And supposing the inoculated and uninoculated to have been equally exposed to infection, one may assume that 14 to 16 deaths from plague would have taken place among the inoculated if no protection had been conferred. As a matter of fact, the large proportion among the inoculated of Parsis and Europeans who have been but lightly attacked by the plague shows less exposure to infection of the inoculated population. On the other hand many of the people who came for protection do so because they happen to have the plague all around them, and persons who were afraid to go into infected places before inoculation often were emboldened to mix freely with plague patients afterwards. Thus, though no very definite conclusions can be drawn from these rough figures, yet the figures, so far as they go, are very distinctly corroborative of the inferences drawn from observation of the House of Correction outbreak already published.

Decrease of the po-  
pulation during the  
epidemic.

512. Many ingenious calculations have been made as to the decrease in the population during the epidemic, but conclusions based on an uncertain foundation, however much they may interest an enquirer in leisure moments, can scarcely deceive a student of statistics.

513. The calculations made of the decrease in the population are all based on the population of 1891, and not on the numbers of the people at the time of the appearance of the epidemic.

514. Speculation based on inferences drawn from calculations of the decrease in the population must be illusory if not vain.

515. The fundamental fact—the increase of population between 1891-97—is not known.

516. Conjectures as to the decrease in the population must be regarded with the interest which attaches to all speculation on a subject of so much importance and of so much interest to many of us.

517. All that is known is that a certain number of people departed from the City by certain ways, by railways and by steamers, and that a certain number entered the City by the same ways.

518. This information, although enough to give a vague or uncertain knowledge of the fluctuations of population, is not sufficient to afford an estimate of the numbers to which the population of the city was reduced. And, moreover,

it is too often forgotten in these speculations that the rate of mortality greatly varies in different classes.

519. While the class amongst whom the mortality is lowest, and whom we wished to remain, left the City in numbers, the class—the poor, the out-caste, and the destitute from famine-stricken districts—whom we did not wish to remain, not only did not fly the City, but increased in numbers. The poor were always with us and increasing in numbers and in destitution.

520. I may quote the opinion of Mr. Baldwin Latham on the reduction of population between November and January, as he is an undoubted authority on mortuary statistics. He writes that the population of Bombay had been “reduced from 806,144 in 1891 to 723,336 in the period of September and January last.”

521. I believe that in this report for the first time statistics have been compiled and published, exhibiting the spread and marking the fatal path of the disease in buildings, through different classes of people and at different age periods. Statistics of mortality.

522. The interest of these statistics is at once as varying and mysterious as the different phases of the disease. Many of the conclusions that the tables suggest are difficult of explanation. And yet an unprejudiced judgment on the progress of the disease and the effect of the measures adopted to check it affirms the wisdom of all ages as handed down to us that the disease spreads most surely and rapidly where the overcrowding of buildings on the ground surface is greatest, and where buildings are closest together, and where least air and light enter. A free current of air is most fatal to the growth of the bacillus in dwellings, and a wholesome body and a hopeful disposition most unfavourable to the growth of the disease in human beings. In dwellings a pure atmosphere and in human beings a vigorous constitution are the best allies against the pestilence. We have gained experience, let us profit by it in the future. That experience cannot be conveyed in truer words than in the words of the admonition given by the *British Medical Journal*, that not one case of Bubonic Plague can be treated as harmless to a community. This knowledge we have gained. Interest of the statistics.

523. When we read the historical accounts of the loss of life from the great epidemics of plague, we can only say, with all who have seen the City, it is wonderful that the mortality has been so little.

524. I have reviewed the progress of the epidemic in the following order :— Arrangement of Report.

- Phenomena that preceded the epidemic.
- Cases.
- Fatality amongst animals.
- Historical movements.
- Progress of events during the epidemic.
- Measures adopted.
- Suggestions from the public.
- The opinions of experts.
- Prophylactic serum.
- Decrease of population.

And I now proceed to examine the statistics of mortality, the results of treatment in hospitals, and finally, to write the concluding portion of the Report.

## Mortality by floors.

525. A statement that I have prepared, a summary of which has been compiled, showing the percentage of deaths to cases by floors in buildings on Mandvi Bunder where the first cases of bubonic plague were recognized, is most interesting and suggestive. It is not possible, except on one fact, to draw any final conclusions from the table, but from that fact the opinion that may be deduced is a remarkable one, for it indicates no less than this, that people living on the road side without homes had better chances of recovery and that a larger proportion of them survived than people living in dwellings.

## Number of

Up to the end of the year 2,544 cases of Bubonic Plague were reported. 1,936 of the cases ended fatally, giving a mortality of 76.10 per cent. The progress of the disease by months, as seen in the number of cases reported, indicates that not nearly so many cases escaped detection in the first months as was generally believed.

In October the number of cases increased to 406, while in November, when the fear of removal to hospital had decreased, the number of cases fell to 339, but the fatality amongst those attacked rose, and in December, after the development of the epidemic, the percentage of deaths to cases decreased it will be noted. This shows that not many cases escaped detection.

The evidence of the mortality does not denote any great concealment of cases. It, however, indicates the vigilance that must have been observed in examining buildings and in obtaining information.

Table showing the number of Attacks and Deaths from Bubonic Plague in 1896.

Months.						No. of Attacks.	No. of Deaths.	Percentage.
September	...	...	...	...	...	135	79	58.51
October	...	...	...	...	...	406	313	77.09
November	...	...	...	...	...	339	273	80.53
December	...	...	...	...	...	1,664	1,271	76.38
Total...						2,544	1,936	76.10

Statement showing the percentage of Deaths to Attacks from Bubonic Plague by Floors.

Wards.	Ground Floor.	First Floor.	Second Floor.	Third Floor.	Fourth Floor.	Fifth Floor.	Residence unknown.	Total.
A	84.0	80.0	70.5	73.3	50.0	33.3	84.2	73.0
B	86.2	78.2	77.0	64.7	64.0	75.0	84.3	77.6
C	78.2	76.3	81.6	72.4	37.5	100.0	83.8	77.5
D	44.5	76.7	63.6	33.3	100.0	.....	83.3	53.6
E	76.0	83.6	73.1	93.3	100.0	.....	88.5	79.1
F	75.5	87.5	.....	.....	.....	.....	100.0	78.1
G	92.8	.....	100.0	.....	.....	.....	75.0	88.8
Total...	74.7	79.0	76.3	66.1	59.0	66.6	85.1	76.1

**A WARD.**

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	...
October...	9	7	8	8	5	4	1	1	...	...	1	1	...	1	26	22
November ...	24	20	11	7	9	7	4	1	...	...	1	...	1	...	50	35
December ...	36	31	20	17	20	13	10	6	8	4	1	...	16	15	111	86
Total ...	69	58	40	32	34	24	15	8	8	4	3	1	19	16	188	143

A = Attack, D = Death.

**B WARD.**

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	8	5	69	50	33	13	8	2	...	...	...	...	...	...	123	70
October...	34	28	87	65	78	67	37	26	16	9	3	2	3	2	253	199
November ...	20	17	39	38	34	33	13	12	4	3	...	...	4	2	114	105
December ...	54	50	94	73	50	41	13	6	5	4	1	1	25	23	242	198
Total ...	116	100	289	226	200	154	71	46	25	16	4	3	32	27	737	572

A = Attack, D = Death.

**C WARD.**

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	2	2	2	1	...	...	...	...	...	...	...	...	...	...	4	3
October...	25	22	22	18	8	6	1	1	2	1	1	1	4	3	63	52
November ...	43	33	25	21	9	8	10	8	1	...	...	...	1	...	89	70
December ...	188	145	141	105	54	44	18	12	5	2	1	1	26	23	433	332
Total ...	258	202	190	145	71	58	29	21	8	3	2	2	31	26	589	457

A = Attack, D = Death.

**D WARD.**

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	...	...	3	3	...	...	...	...	...	...	...	...	...	...	3	3
October...	9	6	2	1	1	1	1	1	...	...	...	...	1	...	14	9
November ...	13	8	4	2	2	1	...	...	...	...	...	...	...	...	19	11
December ...	124	51	34	27	8	5	8	2	1	1	...	...	11	10	186	96
Total ...	146	65	43	33	11	7	9	3	1	1	...	...	12	10	222	119

A = Attack, D = Death.

## E WARD.

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	3	2	1	1	...	...	...	...	...	...	...	...	...	...	4	3
October ...	15	11	10	7	9	6	2	2	1	1	...	...	3	2	40	29
November ...	41	33	12	8	2	2	3	2	...	...	...	...	1	1	59	46
December ...	313	237	179	153	53	39	10	10	1	1	...	...	31	28	587	468
Total ...	372	283	202	169	64	47	15	14	2	2	...	...	35	31	650	546

A = Attack. D = Death.

## F WARD.

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
October ...	3	2	...	...	...	...	...	...	...	...	...	...	...	...	3	2
November ...	4	3	...	...	...	...	...	...	...	...	...	...	...	...	4	3
December ...	38	29	8	7	...	...	...	...	...	...	...	...	2	2	48	38
Total ...	45	34	8	7	...	...	...	...	...	...	...	...	2	2	55	43

A = Attack. D = Death.

## G WARD.

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
October ...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...
November ...	3	3	1	...	...	...	...	...	...	...	...	...	...	...	4	3
December ...	51	49	1	..	1	1	...	...	...	...	...	...	4	3	57	53
Total ...	56	52	2	...	1	1	...	...	...	...	...	...	4	3	63	56

A = Attack. D = Death.

Statement showing Attacks and Deaths according to Floors from September to December 1896.

	Ground Floor.		First Floor.		Second Floor.		Third Floor.		Fourth Floor.		Fifth Floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
September ...	13	9	76	55	38	13	8	2	...	...	...	...	...	...	135	79
October ...	97	76	129	99	101	84	42	31	19	11	5	4	13	8	406	313
November ...	148	117	92	76	56	51	30	23	5	3	1	...	7	3	339	273
December ...	804	592	477	382	186	143	59	36	20	12	3	2	115	104	1664	1271
Total ...	1062	794	774	612	381	291	139	92	44	26	9	6	135	115	2544	1936

A = Attack. D = Death.

\* This includes one death in Harbour.

Table showing the total number of cases and deaths according to floors in each ward from September to December 1896.

Wards.	Ground floor.		1st floor.		2nd floor.		3rd floor.		4th floor.		5th floor.		Residence unknown.		Total.	
	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
A ...	69	58	40	32	34	24	15	8	8	4	3	1	19	16	188	143
B ...	116	100	289	226	200	154	71	46	25	16	4	3	32	27	737	572
C ...	258	202	190	145	71	58	29	21	8	3	2	2	31	26	589	457
D ...	146	65	43	33	11	7	9	3	1	1	...	...	12	10	222	119
E ...	372	283	202	169	64	47	15	14	2	2	...	...	35	31	690	546
F ...	45	34	8	7	...	...	...	...	...	...	...	...	2	2	55	43
G ...	56	52	2	...	1	1	...	...	...	...	...	...	4	3	63	56
Total...	1,062	794	774	612	381	291	139	92	44	26	9	6	135	115	2,544	1,936

A = Attacks, D = Deaths.

526. The following statement showing the number of rooms on each floor of buildings in which cases of bubonic plague occurred on Mandvi Bunder is of great interest. This statement shows the enormous size of the buildings, the density of the house population, and the degree of overcrowding. It will be observed that the ground floors of most of these buildings are used for the storage of articles of merchandise, chiefly food stuffs.

Number of rooms in buildings on Mandvi Bunder where Bubonic Plague was first recognised.

Statement showing the Number of Rooms on each Floor in each House where Cases of Bubonic Plague have occurred on Mandvi Bunder.

Street.	House No.	No. of Rooms on each Floor.						Total.	Number of Persons in House.	Remarks.	
		Ground Floor.	1st Floor.	2nd Floor.	3rd Floor.	4th Floor.	5th Floor.				6th Floor.
Broach Street ...	58A	2	12	14	14	14	...	70	350	On Ground Floor.	
Musjid Siding Road ...	50-54	2	16	16	16	10	...	60	300	2 Godowns.	
Bhandup Street ...	9-13	3	8	6	5	6	...	28	40	2 Godowns, 1 shop.	
Argyle Road ...	172-176	5	22	22	22	...	...	71	55	4 " 1 "	
Do. ...	47	1	1	...	...	...	...	2	12	2 Godowns.	
Musjid Station Road ...	25	3	13	13	13	7	...	49	245	1 Godown, 2 shops.	
Do. ...	24	2	19	18	18	18	...	75	375	2 Godowns.	
Clive Road ...	45	6	25	23	24	22	14	2	116	740	3 Godowns, 3 shops.
Cullian Street ...	33	7	7	...	...	...	...	14	35	1 Godown, 6 "	
Akbar Street ...	Shed	1	...	...	...	...	...	1	6	Iron shed.	
Sholapur Street ...	Shed	1	...	...	...	...	...	1	6	Bullocks' shed.	
Cullian Street ...	45	4	17	16	16	...	...	53	294	2 Godowns, 2 shops.	
Clive Road ...	33	11	13	12	...	...	...	36	150	2 " 9 "	
Musjid Station Road ...	8-9	13	10	10	10	...	...	43	180	.....	
Broach Street ...	60	1	8	8	8	8	8	8	49	288	1 Godown.
Do. ...	70	3	13	13	13	7	...	49	276	3 Godowns.	
Do. ...	80	10	14	13	3	...	...	40	180	5 Godowns, 5 shops.	
Bhandup Street ...	3-5	3	12	12	11	1	...	39	216	1 Godown, 2 "	
Argyle Road ...	56	3	19	18	17	16	...	73	402	2 Godowns, 1 shop.	
Do. ...	2	4	14	14	14	14	...	60	336	2 " 2 shops.	
Clive Road ...	39	5	12	14	2	...	...	33	168	3 " 2 "	
Baroda Street ...	80	3	9	9	9	7	...	37	204	2 " 1 shop.	
Bhandup Street ...	17	4	12	12	12	7	...	47	258	2 " 2 shops.	
Musjid Siding Road ...	22	7	15	15	13	...	...	50	250	4 " 3 "	
Argyle Road ...	22	3	8	9	4	...	...	24	120	2 " 1 shop.	
Musjid Station Road ...	12-13	9	12	12	13	11	...	57	288	8 " 9 shops.	
Raichore Street ...	Shed	1	...	...	...	...	...	1	6	Bullocks' shed.	
Broach Street ...	108-112	2	8	8	8	...	...	26	144	1 Godown, 1 shop.	
Bhandup Street ...	19-21	5	8	8	...	...	...	21	96	1 " 5 shops.	
Raichore Street ...	Shed	1	...	...	...	...	...	1	6	Bullocks' shed.	





*Statement showing the number of cases of Bubonic Plague and the date of attack  
and death in buildings on Mandvi Bunder.*

Street.		House No.	KEY. Roman figures indicate date of attack and italics indicate date of death.
1	Broach Street ... ..	58-A	25·8—37·8 ; 11·9—16·9 ; 12·9 ; 18·9 ; 22·9 ; 28·9—1·10 ; 8·10—12·10 ; 23·12—30·12 ; 31·3 ; 25·4—28·4
2	Argyle Road ... ..	172-176	16·9—18·9 ; 20·9—21·9 ; 22·9—26·9
3	Cullian Street ... ..	83	17·9—20·9 ; 18·9—24·9 ; 18·9 ; 21·9—25·9
4	Bhandup Street ... ..	9-13	18·9—24·9 ; 19·9 ; 20·9—25·9 ; 22·9 ; 28·9 ; 4·4
5	Akbar Street ... ..	Shed	18·9—25·9
6	Musjid Siding Road ... ..	50-54	20·9—23·9 ; 25·9—27·9 ; 16·10 ; 16·10 ; 17·10 ; 21·10 ; 21·10 ; 22·10—26·10 ; 30·10—2·11 ; 2·11
7	Musjid Siding Road ... ..	22	20·9—24·9 ; 22·9 ; 24·9 ; 23·9 ; 28·9 ; 25·9— 30·9 ; 25·9—27·9 ; 26·9—30·9 ; 27·9—29·9 ; 27·9—4·10 ; 28·9 ; 30·9—3·10 ; 30·9—3·10
...	Do. ... ..	22	1·10—3·10 ; 1·10—3·10 ; 2·10 ; 2·10—3·10 ; 2·10 ; 2·10
8	Argyle Road ... ..	22	20·9—25·9 ; 20·9—27·9 ; 27·9—29·9 ; 28·9— 30·9 ; 30·9—30·10
9	Musjid Station Road ... ..	25	20·9—23·9 ; 27·9—30·9 ; 2·10 ; 25·10—26·10
10	Argyle Road ... ..	47	20·9—24·9
11	Musjid Station Road ... ..	24	21·9 ; 28·9 ; 28·9—3·10 ; 1·10 ; 1·10 ; 7·10 ; 20·10 ; 27·3 ; 11·5
12	Clive Road ... ..	45	21·9—29·9 ; 21·9—26·9 ; 22·9—25·9 ; 23·9— 25·9 ; 26·9—5·10 ; 26·9 ; 27·9—1·10 ; 27·9 —30·9 ; 28·9—30·9 ; 28·9—4·10 ; 29·9 ; 30·9—5·10 ; 6·10—15·10 ; 7·10 ; 29·9 ; 16·3—22·3 ; 24·3—27·3 ; 15·4—17·4 ; 29·4 ; 18·5—23·5
13	Sholapur Street ... ..	Shed	21·9—25·9
14	Broach Street ... ..	70	22·9 ; 27·9 ; 27·9—28·9 ; 28·9 ; 10·4—11·4 ; 11·4
15	Bhandup Street ... ..	17	22·9
16	Broach Street ... ..	80	25·9—27·9 ; 2·4—10·4 ; 12·4—14·4 ; 24·4
17	Cullian Street ... ..	45	26·9—27·9 ; 2·10—4·10 ; 3·4—6·4 ; 2·5 ; 25·5— 27·5 ; 12·6—13·6 ; 18·6—21·6
18	Broach Street ... ..	60	26·9—27·9 ; 27·9—30·9 ; 17·10
19	Musjid Station Road ... ..	8-9	26·9—1·10 ; 26·9
20	Argyle Road ... ..	56	26·9—29·9 ; 27·9—30·9 ; 7·10 ; 8·10—10·10 ; 8·4
21	Baroda Street ... ..	80	26·9 ; 27·9 ; 27·9—29·9 ; 29·9—2·10 ; 30·9— 1·10 ; 2·10 ; 24·10—27·10
22	Bhandup Street ... ..	1-7	27·9—28·9 ; 27·9—30·9 ; 28·9 ; 16·10—25·10 ; 16·10—19·10 ; 17·10 ; 15·3—20·3 ; 22·3
23	Clive Road ... ..	39	27·9—29·9 ; 4·10—4·10 ; 4·10
24	Do. ... ..	33	27·9 ; 1·10—4·10
25	Raichore Street ... ..	Shed	28·9—30·9
26	Argyle Road ... ..	66	28·9—18·10 ; 16·10—18·10 ; 18·10 ; 20·10— 25·10 ; 20·3—30·3 ; 21·5 ; 27·5
27	Do. ... ..	2	29·9—4·10 ; 6·10 ; 16·10 ; 17·10 ; 25·10— 28·10 ; 27·10 ; 7·11—8·11 ; 19·11—21·11 ; 16·3—20·3 ; 1·4—3·4 ; 7·4 ; 13·4—15·4 ; 16·4—17·4 ; 18·4 ; 24·4—25·4
28	Musjid Station Road ... ..	12-13	29·9—3·10
29	Bhandup Street ... ..	19-21	5·10
30	Raichore Street ... ..	Shed	6·10—8·10

	Street,	House No.	Key. Roman figures indicate date of attack and italics indicate date of death.
31	Musjid Station Road ...	28	7·10; 9·10; 18·10; 31·10
32	Surat Street... ..	66-68	6·10— <i>12·10</i> ; 29·3; 3·4
33	Clive Road 2nd Cross Lane.	Stable	7·10
34	Clive Road ... ..	16	9·10; 15·4
35	Mallet Bunder ... ..	Road-side	12·10; 12·3
36	Argyle Road Cross Lane ...	30	15·10; 30·10— <i>4·11</i> ; 23·3— <i>26·3</i>
37	Musjid Siding Road ... ..	32-36	16·10— <i>18·10</i>
38	Russel Street ... ..	3	17·10— <i>20·10</i>
39	Broach Street ... ..	108-112	1·10— <i>4·10</i> ; 18·10— <i>23·10</i>
40	Clive Road ... ..	9-11	12·10; 14·5; 23·5
41	Do. ... ..	23	23·10; 27·10— <i>28·10</i>
42	Raichore Street ... ..	Shed	24·10— <i>26·10</i>
43	Clive Road 2nd Cross Lane...	10-12	24·10— <i>27·10</i>
44	Russel Street ... ..	1	30·10
45	Argyle Road ... ..	252	30·10; 25·11— <i>28·11</i>
46	Musjid Siding Road ... ..	56-60	2·11— <i>6·11</i> ; 14·11— <i>20·11</i> ; 16·11; 9·4— <i>10·4</i>
47	Broach Street ... ..	90-92	21·11— <i>24·11</i> ; 23·3— <i>30·3</i> ; 27·3

Mortality small.

529. The mortality has been so small in proportion to the numbers and the pressure of the population and the density of the houses that, it has suggested to some authorities that there may be another severe epidemic. All who have seen the charts of mortality have ascribed the repressions in the mortality to the influence of the sanitary measures adopted. There can be no doubt that the measures adopted have reduced and lightened the mortality. There is no reason except the influence of the measures carried out, why in this city more densely crowded than any city in the British Empire, the mortality has not been much greater.

530. The plan attached is very interesting as showing the order in which recognised cases occurred on Mandvi Bunder, and it will be observed that the cases did not occur in order of proximity of position. It is remarkable that up to the end of 1896, cases had not occurred in 15 of the streets on Mandvi Bunder.

531. The many members of the Scientific Missions I have taken round the city have all been astonished at three conditions in our city.

- (a) The size of the buildings and the number of the people living in them.
- (b) The density of the population.
- (c) The cleanliness of the densely populated portions of the city.

532. Dr. Rogers Pasha stated that the worst portions of Bombay were better than most parts of Cairo.

Table showing the number of Deaths and the Death-rate from Bubonic Plague by Sections during 1896.

Sections.	Population by Census of 1891.	No. of Deaths from Bubonic Plague.	Rate of Mortality per 1,000 of Population.
Upper Colaba	4,335	1	·23
Middle and Lower Colaba...	13,622	77	5·65
Fort, Southern	3,951	2	·50
Fort, Northern	32,847	46	1·40
Esplanade	10,064	1	·09
Mandvi	37,295	308	8·25
Chukla	32,197	58	1·80
Umarkhadi	52,466	84	1·60
Dongri	30,317	95	3·13
Market	44,751	87	1·94
Dhobi Talao	39,945	110	2·75
Fanaswadi	24,069	32	1·32
Bhulshwar	38,363	68	1·77
Khara Talao	27,035	51	1·88
Kumbharwada	32,209	83	2·57
Khetwadi	28,814	48	1·66
Girgaum	26,999	42	1·55
Chaupati	11,512	7	·60
Walkeshwar	12,990	5	·38
Mahalakshmi	17,014	7	·41
Mazagon	33,640	93	2·76
Tarwadi	21,298	20	·93
2nd Nagpada	18,768	29	1·54
Kamathipura	29,203	227	7·77
Tardeo	18,980	31	1·63
Byculla	47,403	88	1·85
1st Nagpada	11,133	27	2·42
Parel	28,740	23	·80
Sivri	6,063	13	2·14
Sion	19,601	5	·25
Mahim	18,565	12	·64
Worli	25,493	41	1·60
Water Division	22,142	2	·09
Non-resident and unknown	.....	113	.....
Total...	821,764	1,936	2·36

533. Up to the end of 1896, the highest mortality from Bubonic Plague had occurred in Mandvi, 308 deaths having been registered, equal to a mortality of 8·25 per 1,000, while in Kamathipura the death-rate was 7·77, Middle and Lower Colaba 5·65, Dongri 3·13, Dhobi Talao 2·75, Mazagon 2·76, Kumbharwada 2·57, and 1st Nagpada 2·42. The lowest mortality was registered in the Esplanade, ·09. Yet this section joins Mandvi on the north and is separated by only the Carnac Bunder Bridge Road. It is interesting that, although in the Esplanade on the Mandvi side there are chawls occupied by numbers of low-castes, amongst others the Municipal scavengers, working in Mandvi, the disease had not spread to the locality. It will also be observed that in the north of the Island, only 5 cases had occurred—in Sion on the east, and 12 in Mahim on the west, while further south in Parel the disease was advancing, and 23 deaths had occurred. In the district immediately on the city side of Mahim, viz., Worli, 41 deaths had occurred. If we go to the west side of the Island, we find that in Chaupati only 7

Mortality from Bubonic Plague by districts.

deaths had occurred, while further west in Walkeshwar and Mahalakshmi only 5 and 7 deaths had been registered.

Decline of mortality  
in Mandvi.

534. The mortality in Mandvi commenced to decline in the end of October, but the progression of the disease was observed to continue westward, southward and northward.

The progression of  
the disease; its  
course did not  
follow the migration  
of the population.  
Gradual progression  
of the disease, due  
to the migration of  
rats.

535. The table showing the mortality by Sections read with the diagram, exhibiting the order of the occurrence of the first cases, shows the steady progression of the disease from east to west and from south to north. It may be observed that to the extreme north and to the extreme west of the Island, the disease had only spread by the end of the year. The gradual progression of the disease seems to have been due to the migration of rats. There is no other explanation that occurs to me, for, had the disease followed the course of the migration of the population, it would at this period have been most general and fatal in the north and west of the island in the localities whither people had migrated in thousands in the beginning of October and in large numbers afterwards. As I have observed before, there was a steady progression in the disease. A movement from the foreshore on the east that seemed to follow the migration of rats from one district to another, as in a garden having many buildings, when the rats are poisoned in one building, they migrate to another, so in the city they seemed to advance when sick from one district to another.

536. Previous to the appearance of the disease in an epidemic form in Walkeshwar, large numbers of rats were found dead on the paths leading to the hill. They attracted our attention, lying, as they did, in one characteristic position.

537. It will be observed from the diagram of the progress of the disease across the Island to the Walkeshwar district that up to a late period, although a number of cases had occurred in the intervening districts and in the same locality of Walkeshwar, the disease had not become epidemic in Walkeshwar, but when that period—the epidemic period as I may call it—in the progression of the disease arrived, and the epidemic had spread across the intervening districts to Walkeshwar and not till then the disease became epidemic in this district. It has to be carefully noted whether there is a direct connection between the sporadic cases and the cases of the epidemic period that appear to follow them at varying intervals. The term incubation applied to the period intervening between the time of the first observed case and the occurrence of other cases is very vague.

538. The following experiences are interesting and support the conclusions that experience in this City suggests. Surgeon-Lieutenant-Colonel Henderson, in a paper before the Bombay Medical and Physical Society, June 21st, 1837, writes:

In Karachi, the City Railway premises, which were under my charge, were entirely free from infection until dead rats were found in the warehouses adjoining the servants' quarters. A few days after this cases of plague occurred among the railway employes. In Hyderabad I find, after careful investigation, that the appearance of local cases immediately succeeded the appearance of infected dead and dying rats. I do not say that the disease might not become epidemic without such agency, but from my own observation, I believe that the time of local incubation is, as a rule, the time between the importation of a case and the infection of the rats.

539. The death of rats is not the first phenomenon. Previous to this there is a migration of the animals. It may be the instinct of safety urging the animals to fly from danger. A very remarkable instance of this occurred at a residence in a large garden on Bandra Hill near Bandra Point. Rats had not been seen either in this garden or in the house up to the 21st of January 1897. But about that time a large number of rats came into the garden, and some of them died, and some of them that had been killed by cats appeared to have made the cats ill or infected them. Ten days after, one of the servants in the house, who had not been to Bombay for weeks, died in 12 hours from Bubonic Plague. No other case occurred here. Veterinary-Major Mills informs me that he also observed the migration of rats from his house before the appearance of the disease and the occurrence of a case.

The migration of rats. The first phenomenon.

540. The occurrence of the first cases on the upper stories over godowns and on the top floors of buildings and, in one instance, only in the rooms, opening to the east suggested the view maintained by Dr. Waters that the disease was connected with the grain supply. Some of the rooms in which the first cases occurred in Mandvi faced to the east, namely, to the side of the grain stores.

541. The total mortality commenced to ascend in the last two weeks of November. In these two weeks the sky became clouded. The rise in the mortality and the increase in the extent of clouded sky at this period is shown in the diagram, and although there may be no connection between the state of the atmosphere and the progress of the mortality from Bubonic Plague, the coincidence of a mortality increasing and an epidemic reviving with a clouded sky was repeated.

Progress of the epidemic.

542. When the diagram of the mortality from day to day is closely examined it will be seen that the course of the epidemic is marked out and that it may be divided into three periods :—

- I. Commencing on the 19th of September and ending on the 15th of October.
- II. Commencing after the 15th of October and ending on the 4th of November.
- III. Commencing after the 4th of November and, after a series of repressions, developing into the great epidemic which culminated in a high mortality on the 28th of December, and reached its greatest intensity and virulence about the 15th of January.

543. I offered an opinion on the 27th of January on the statement published in the Government Gazette showing the number of deaths and the mortality in the week ending the 26th of January, that few, except the Commissioner, Mr. Vincent, Sir George Cotton and Mr. P. M. Mehta, were disposed to accept.

My opinion on the 27th of January that the epidemic had reached its maximum.

I wrote on the progress of the epidemic in that memorable week that :—

The state of the public health during the last days of the week was more favourable than in the preceding week, and a large decrease in the mortality may be anticipated during the following week. It has to be remembered that the increase in the mortality during recent weeks has not been proportionately heavy to the appearance and development of Bubonic Plague over the Island. During October 1896 when Bubonic Plague was prevalent in the one district of Mandvi representing a population of 37,295, the total number of deaths rose to 791 in the week ending 6th October, and while in December when Bubonic Plague was prevalent over the Island, the mortality advanced in the week ending 29th December to only 1,853.

The measures that have been adequate to stamp Bubonic Plague out of the district of Mandvi have been and will be sufficient to stamp the disease out of all the districts in which the disease has been or now is. A prevalent progressive decrease in the mortality may now be hoped for.

544. From the week ending the 9th of February the weekly mortality declined (with the exception of one week) continuously till the end of May.

Incidence of  
mortality.

545. If, however, the incidence of the mortality by days is more closely examined, it will be observed that, as in the ascent in the development of the mortality so in the descent in the decadence of the pestilence, there were successive periods of fluctuation and recrudescence. In the decadence of the pest as in the period of its growth, it languished or revived.

546. The line of the incidence of the mortality in different classes indicates that the disease followed nearly the same course in two classes of the population—Hindus and Hindu Out-castes—and, with numerous repressions, reached its maximum intensity in February.

547. The mortality in the Parsee community rose from the middle of December more continuously than in any other community, and declined very unevenly. The mortality amongst Mussulmans and Europeans followed a not dissimilar course marked by a series of small elevations and depression. The lower range of mortality shown in the diagram amongst Europeans and Mussulmans than in any other classes is very remarkable, and yet these are the two classes that departed from the City in the smallest numbers.

548. It has to be remembered that a greater number of cases occurred amongst Mussulmans than shown in the statistics, although the diagram shows that in April, when the total number of deaths amongst Mussulmans was large, and when segregation was enforced, and when the general mortality in the City had greatly declined, and long after the epidemic had passed over the localities chiefly inhabited by Mussulmans, the death-rate from Bubonic Plague was very slightly higher than before in this community.

549. In Lower Colaba, Bubonic Plague began to be epidemic in the beginning of October.

550. In Umarghadi, it began to be epidemic at the beginning of November.

551. In Dongri, it began to be epidemic in the second week of November.

552. In Chukla, it began to be epidemic in the middle of November.

553. In the Fort (North), it began to be epidemic in the first week of December.

554. In the Esplanade, Bubonic Plague began to be mildly epidemic in the middle of December.

555. In Fort (South), it began to be mildly epidemic in the third week of December.

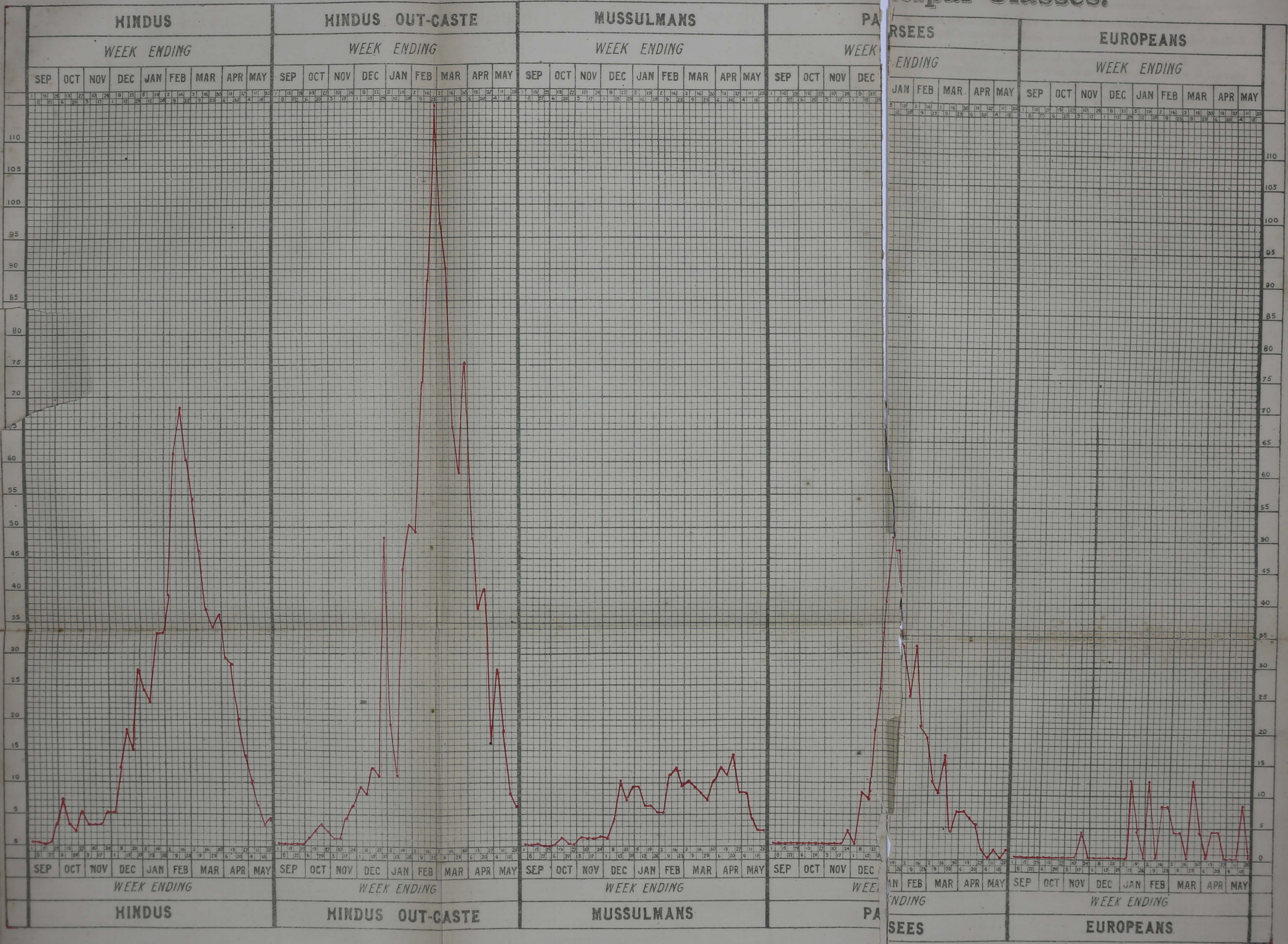
556. In Upper Colaba, it began to be epidemic at the end of January.



# DIAGRAM.

1896 1897

## Weekly Mortality from Bubonic Plague in Principal Classes.





557. The operations of the Plague Committee practically commenced on the 1st of April, although I organized the first house-to-house inspection on the 17th of March. It will be observed that, with the exception of one period, the fall in the mortality was continuous through the weeks preceding and following the appointment of the Plague Committee. The disease had reached its maximum intensity before the end of January. The greatest number of deaths on any one day occurred on the 15th of January. The Plague Committee was appointed on the 5th of March.

Effect of the operations of the Plague Committee. The mortality continued to decline in the same ratio as before.

558. The table shows that the mortality continued to decline after the operations of the Plague Committee had commenced in the same ratio that it had decreased before. It is very remarkable this uniformity in the decrease of mortality before and after the operations of the Plague Committee.

559. The epidemic had declined and the mortality had fallen for weeks before compulsory segregation was attempted by the Plague Committee.

560. Looking at the table, it must be admitted that the decrease in the mortality followed very much the same course after as before the formation and operations of the Plague Committee.

561. The figures indicate that the measures of the Plague Committee had no more perceptible influence on the decrease in the mortality than the measures of the Health Department. While, if we take one class of the population—Mussulman—they seem, difficult as it is to explain the cause, to have had less effect. There is no other possible conclusion to be drawn from this table.

562. The table printed hereafter showing the decrease each week in the mortality is of great interest :—

*Table showing the Fluctuation in the Number of Deaths each Week after the Week ending the 9th February and the Percentage of Fluctuation.*

Week ending					Total number of Deaths excluding Still-born.	Percentage of Decrease.	Remarks.
1897.							
16th February	...	...	...	...	1,710	9·5	
23rd do.	...	...	...	...	1,634	4·4	
2nd March	...	...	...	...	1,467	10·2	
9th do.	...	...	...	...	1,311	10·6	
16th do.	...	...	...	...	1,242	5·2	
23rd do.	...	...	...	...	1,115	1·02	
30th do.	...	...	...	...	1,120	·4	Increase.
6th April	...	...	...	...	997	10·9	
13th do.	...	...	...	...	949	4·8	
20th do.	...	...	...	...	817	13·9	
27th do.	...	...	...	...	642	21·4	
4th May	...	...	...	...	621	3·2	
11th do.	...	...	...	...	541	12·8	
18th do.	...	...	...	...	529	2·2	
25th do.	...	...	...	...	516	2·4	



563. The incidence of the mortality by occupation varies even more than by class. I take two classes—the Police and the servants of the Tramway Company.

564. The Police when they lived in insanitary buildings in the city suffered severely.

Mortality in the Police and amongst the servants of the Tramway Company.

565. The servants of the Tramway Company when placed in huts suffered as little as the most favoured classes. The returns attached, showing the number of servants of the Tramway Company attacked with Bubonic Plague, is very interesting. I am indebted for this return to the courtesy of Mr. Remington. It will be seen that 54 cases came under observation, and that they all terminated fatally; other cases may have occurred, but they were removed from under the observation of the Company. Mr. Remington was of opinion that but for the segregation of a large number of the staff in camps a greater number of cases would have occurred. This is very probable. At Falkland Road, where the Company had erected for the segregation of the establishment huts on open ground and segregated about 150 men in the camp, not one case occurred, and yet the huts were in the centre of a district greatly affected—the district of Kamathipura.

*Return of Cases and Deaths from Bubonic Plague amongst the Servants of the Bombay Tramway Company.*

Ranks.	Castes.	Attacks.	Deaths.	Remarks.
Inspectors ...	Mussulman ...	...	...	
„ ...	Christian ...	1	1	
„ ...	Hindu ...	6	5*	* One of these cases occurred in the Colaba Tents, the property of the Company. The remainder in different parts of the City.
Conductors ...	Mussulman ...	...	...	
„ ...	Parsee ...	1	1	
„ ...	Hindu ...	7	5	
Drivers ...	Mussulman ...	8	7†	† These cases occurred in the Colaba Tents, the property of the Company; among them 1 woman and 1 child 10 years of age.
„ ...	Hindu ...	5	4	
Horse-keepers.	Mussulman ...	...	...	
„ ...	Hindu ...	3	3‡	‡ 8 of these cases occurred at Parel, 5 at Colaba. 11 were men, 2 were women.—All of these reside in chawls or camps, the property of the Company.
Stablemen ...	Mussulman ...	10	10‡	
„ ...	Hindu ...	...	...	
Office Clerks.	Mussulman ...	...	...	
„ ...	Hindu ...	3	2§	§ These cases occurred in the City.
Mechanics ...	Mussulman ...	...	...	
„ ...	Hindu ...	10	4	These cases occurred in the City.

The Police Force.

566. The mortality amongst the Police Force is significant. It will be observed that in the Mounted Police only 3 men were attacked. This may possibly have been due to the Mounted Police being so much on horseback and wearing

boots or puttees, while the Foot Police wear slippers. They are all very long-hours on duty. The proportion of cases in the Force amongst Hindus is much higher than amongst the Mussulman. Some of the cases occurred in very ill-lighted and ill-ventilated buildings in rooms in absolute darkness, in which it was necessary to have a lamp to see during the day time. I found cases amongst men in the Police in some of the most insanitary buildings. A comparison between the mortality amongst the Police living outside the Police Quarters, and the mortality amongst the Force living in Barracks and amongst the establishment of the Health Department shows that in well-ventilated buildings the disease does not easily develop. The case returned amongst the European Police occurred in Frere Road, Mandvi Bunder, and was the only one in that street. It was a mild case and it occurred after the epidemic in Mandvi had declined.

*Statistics of Bubonic Plague in the Bombay Police Force.*

	Attacks.	Deaths.	Number of Persons attacked living in Police Barracks (Lines).	Number of Persons attacked living outside the Barracks (Lines).	Remarks.
European Police ... ..	1	...	...	*1	*In quarters hired for him by Government who paid the rent.
Mounted Police, Mahomedans..	2	2	2	...	
"    Hindus ... ..	1	1	1	...	
Foot Police, Mahomedans ...	11	7	...	11	
"    Hindus ... ..	99	44	1	98	
Extra Police, { Mahomedans...	3	2	...	3	
Ramoshis. { Hindus ... ..	38	26	...	38	
Total ... ..	155	82	4	151	

*Statement showing the Strength by Class of the Bombay City Police Force.*

Strength.	Christians.	Parsees.	Jews.	Hindus.	Mahomedans.	Total.
Bombay ... ..	82	7	1	1,603	538	2,231

567. The mortality from all causes by sections when studied with the incidence of the mortality from Bubonic Plague in districts is most suggestive in its results and supports the opinion offered in other portions of the report, that the chief condition influencing the occurrence of Bubonic Plague in localities is the ventilation of buildings. I take the mortality from all causes for the purpose of examination. The incidence of the total mortality gives probably the truest representation of the progress and spread of the epidemic of Bubonic Plague as in the beginning the recognition of Bubonic Plague was very uncertain. On the opinion that the incidence of the disease is most influenced by the ventilation of buildings our policy was based. In localities, the worst ventilated and the most densely covered with buildings, the incidence of the disease was greatest. As it was with localities, so it was with buildings. While in open houses it was

The chief condition influencing the mortality.

Ventilation, the chief protection in localities or buildings.

difficult to contract the disease, in bad ones it was difficult to escape it. An illustration of the truth of this conclusion is to be found in the circumstance that fewest cases occurred in buildings around open spaces, such as gardens, tanks, stable yards or even graveyards. The buildings around graveyards lightly escaped, not because of the graveyards, but because of the open spaces over the graveyards. The six sections of highest mortality are six of the most densely populated sections of Bombay—six of the sections with the darkest buildings, six of the sections with the dampest buildings, and five out of the six are sections of the worst drainage and greatest soil pollution.

Sections of highest mortality.

568. Take these six sections and arrange in a table, as I do, hereafter the statistics of the density of population in each of them to the—

1. Ground surface | 2. Building room

and it will be seen that the state of overcrowding, and, with the overcrowding, the air pollution in these portions of the city is appalling.

569. Dr. Cleghorn, who carefully day after day examined houses in each street in Kamathipura, was greatly impressed by—

- A. The imperfect ventilation of the buildings ;
- B. The concentration of population ;
- C. The waste of water and the dangerous position in which water-pipes were placed.

He observed that in the little space at the back of each house, now generally open to the sky, the roof having been taken off by the Health Department, there was a privy on one side and a water-pipe on the other. This is the little space in which the clothes are washed. These are, it must be admitted, conditions of dwelling most favorable to the development of disease.

570. The state of the buildings in one of these sections—Kamathipura—is well described in a report from one of our Medical Officers. He writes: “I have gone through all the houses and almost all the rooms on the ground floor and most of the houses are not fit for human habitation owing to want of light and ventilation.”

571. The position in respect of the erection of buildings on old foundations is this. People have erected dwellings without sufficient open space around them for ventilation and light, and they cannot be prevented from rebuilding them, however unfit the buildings may be, for human occupation.

Sections of highest mortality.	Square yards to a person.	Persons to a house.
2nd Nagpada ... ..	10· 8	34·43
Kamathipura ... ..	11· 6	21·72
Khara Talao ... ..	7·22	37·54
Mandvi ... ..	25· 8	22·41
Oomercarry ... ..	41· 8	29·40
Tardeo ... ..	41· 8	26·69

Table showing the number of Deaths and the Death-rate from all Causes  
by Sections during 1896.

Wards.	Sections.	Population by Census of 1901.	Number of deaths exclusive of still-born.	Mortality per 1,000 of popula- tion.	
A	Colata ... {	Upper ... ..	4,335	111	25.60
		Middle and Lower ... ..	13,622	525	38.54
	Fort ... {	Southern ... ..	3,951	21	5.31
		Northern ... ..	32,847	1,986	33.96
	Esplanade ... ..	10,064	184	18.28	
B	... {	Mandvi ... ..	37,295	1,945	52.15
		Chuckla ... ..	32,197	1,549	47.83
		Umarkhadi ... ..	52,466	2,629	50.10
		Dongri ... ..	39,317	1,257	41.46
C	... {	Market ... ..	44,751	1,400	31.28
		Dhobi Talao ... ..	39,945	1,694	42.49
		Fanaswadi ... ..	24,089	651	28.29
		Bhuleshwar ... ..	38,363	1,495	38.96
		Khara Talao ... ..	27,035	1,462	54.07
		Kumbharwada ... ..	32,209	1,524	47.31
D	... {	Khetwadi ... ..	23,814	891	39.92
		Girgaum ... ..	26,999	1,153	43.81
		Chauapati ... ..	11,512	242	21.02
		Walkeshwar ... ..	12,990	249	19.16
		Mahalakshmi ... ..	17,914	300	17.63
E	... {	Mazagon ... ..	33,640	1,352	40.19
		Tarwadi ... ..	21,298	713	33.47
		2nd Nagpada ... ..	18,768	1,278	68.09
		Kamathipura ... ..	29,293	1,979	67.76
		Tardeo ... ..	18,980	925	48.73
		Byemla ... ..	47,493	2,182	46.03
		1st Nagpada ... ..	11,133	450	40.42
F	... {	Parel ... ..	23,749	999	31.62
		Sewri ... ..	6,653	295	33.81
		Sion ... ..	19,691	521	26.58
G	... {	Mahim ... ..	13,595	704	28.04
		Worli ... ..	25,493	959	37.61
Water Division	... ..	22,142	92	4.15	
Non-resident and unknown	... ..	...	763	...	
	Total...	821,764	33,451	40.71	

Mortality from  
Bubonic Plague by  
Sections.

572. I have already stated that the highest mortality from Bubonic Plague was registered in Mandvi, 308 deaths out of a total mortality of 1,945, giving a death-rate of 8·25 per 1,000. After Mandvi, Kamathipura suffered most, 227 deaths having occurred, equal to a death-rate on the population of 7·77. Middle and Lower Colaba, which was most affected after Mandvi and Kamathipura, had a mortality of 77 deaths, equal to a death-rate of 5·65 per 1,000. The first cases in Middle and Lower Colaba were labourers in the cotton godowns, and they were going backwards and forwards between Mandvi and Colaba. It is a curious coincidence that the first cases in Mandvi occurred over godowns and that the first cases in Middle and Lower Colaba occurred in godowns. In Dongri, a district adjoining Mandvi, the incidence of the mortality is next in severity to Colaba. It is remarkable that it was not higher, as the two districts are separated by a narrow road, on the north side of which is Dongri, and on the south side of which is Mandvi with high and crowded houses on either side. From the beginning people were going backwards and forwards from Mandvi to Dongri and from Dongri to Mandvi. The labouring classes in Mandvi moved about constantly from houses where cases occurred. A very remarkable instance of immunity was observed in the case of the Common Jail in the Mandvi ward. Not one case occurred in this jail amongst over 300 prisoners, although the buildings are in the centre of an infected area.

573. It will be observed from the table showing the mortality by sections that up to the end of the year the mortality in the districts to the extreme west and to the extreme north of the Island was very small. On the west in Chaupati, at the foot of Malabar Hill, only 7 deaths had as yet occurred, but the epidemic was soon to spread to Chaupati on its course west. In Walkeshwar on the hill above Chaupati, only 5 deaths had been registered, and in Mahalakshmi, further north, only 7; and if we cast our glance further north, we see that in Worli, in only one portion of which—the extreme north, the Worli Village—the disease had appeared, 41 deaths had been reported, while in Mahim, still further north, only 12 deaths had occurred.

574. On the east of the Island we find that on the Mazagon foreshore as many as 93 deaths had been recorded, while in Tarwadi, a district between Mazagon and the districts chiefly affected, only 20 deaths had occurred. Tarwadi is on the north of Dongri, and Mandvi is on the south of Dongri. In the next district further off and more north than Tarwadi, the mortality was higher than in Tarwadi, but further north still on the confines of the Island in the Section of Sion only 5 deaths had occurred.

575. The incidence of the cases in some localities, notably in Kamathipura, where in each street for days 1 or 2 cases occurred daily, suggested an inoculator being at work. Dr. Choksey, in reference to direct inoculation, writes:—“From observation on nearly 1,000 cases of plague at the Arthur Road Hospital, it appears that not more than about 5 per cent. of the cases show any traces of direct inoculation. And even amongst these it is not always possible to fix the exact point of entrance of the virus into the system. No case of plague from rat-bite has hitherto been observed.”

576. The largest number of cases on Malabar Hill occurred in the group <sup>Cases on Malabar Hill.</sup> of houses on lower ground than the water reservoir. This is most interesting as illustrating the effect of moisture on the incidence of the disease. The bungalows are on sloping ground below the reservoir, and the locality has no drains. The houses are drained by open channels to cesspools. In the servants' quarters of 7 bungalows, 23 cases occurred. Of the 23 cases, 9 occurred as late as February, and 14 happened in March. These cases occurred notwithstanding every measure taken in advance of the disease.

Table showing the number of Deaths and Death-rate per 1,000 from  
Bubonic Plague by Sections in 1896.

Ward.	Sections.	Population.	No. of Deaths in 1896.	Death-rate per 1,000.
A	Upper Colaba ... ..	4,225	1	·23
	Middle and Lower Colaba ... ..	13,622	77	5·65
	Fort, Southern ... ..	3,951	2	·50
	Fort, Northern ... ..	32,847	46	1·40
	Esplanade ... ..	10,064	1	0·9
B	Mandvi ... ..	37,295	308	8·25
	Chuckla ... ..	32,197	58	1·80
	Umarkhadi ... ..	52,466	84	1·60
	Dongri ... ..	30,317	95	3·13
C	Market ... ..	44,751	87	1·94
	Dhobi Talao ... ..	39,945	110	2·75
	Fanaswadi ... ..	24,069	32	1·32
	Bhuleshwar ... ..	33,363	68	1·77
	Khara Talao ... ..	27,035	51	1·88
	Kumbharwada ... ..	32,209	83	2·57
D	Khetwadi ... ..	23,814	48	1·66
	Girgaum ... ..	23,999	42	1·55
	Chanpati ... ..	11,512	7	·60
	Walkeshwar ... ..	12,990	5	·38
	Mahalakshmi ... ..	17,014	7	·41
E	Mazagon ... ..	33,640	93	2·76
	Tarwadi ... ..	21,293	20	·93
	2nd Nagpada ... ..	18,768	29	1·54
	Kamathipura ... ..	29,203	227	7·77
	Tardeo ... ..	18,980	31	1·63
	Byculla ... ..	47,403	83	1·85
	1st Nagpada ... ..	11,133	27	2·42
F	Parel ... ..	28,740	23	·80
	Sewri ... ..	6,063	13	2·14
	Sion ... ..	19,601	5	·25
G	Mahim ... ..	18,505	12	·64
	Worli ... ..	25,493	41	1·60
Water Division ... ..	...	22,142	2	·09
Non-resident and unknown ... ..	...	...	113	...
Total...		821,764	1,936	2·36

Mortality from Bubonic Plague by class.

577. From the table showing the mortality by class, it will be seen that amongst the large communities, with the single exception of Jains, the mortality up to the end of 1896 had not risen above 2·91 per 1,000. It will also be observed that, with the exception of Europeans, the mortality is lower amongst Mussalman than in any other large class. The death-rate amongst Europeans was ·08 per 1,000 and amongst Eurasians ·92, only 4 deaths having occurred in the latter community.

578. The mortality amongst Jains is unequally distributed by sex, being 8·69 amongst males and 6·77 amongst females. The inequality in the ratio of sex-mortality amongst Bhatias was probably due to females leaving Bombay and a reduction in the female population.

579. The inequality in the sex-mortality is very great amongst Mussalmans, being 1·18 amongst males and ·768 amongst females.

580. Amongst Parsees the ratio of mortality amongst males and females was more equal than in most other classes.

Table showing the number of deaths from Bubonic Plague in different classes and the death-rate per 1,000 of population in the year 1896.

CLASSES.	Males.			Females.			Persons.		
	Popula- tion.	Number of Deaths.	Rate per 1,000.	Popula- tion.	Number of Deaths.	Rate per 1,000.	Popula- tion.	Number of Deaths.	Rate per 1,000.
Jains ... ..	19,317	168	8·69	5,908	40	6·77	25,225	208	8·28
Brahmins ... ..	26,554	70	2·63	11,418	20	1·75	37,982	90	2·34
Lingajets ... ..	462	6	12·98	322	...	...	784	6	7·65
Bhatias ... ..	4,344	19	4·37	3,547	4	1·12	7,891	23	2·91
Hindus of other caste.	288,569	811	2·79	162,896	379	2·32	451,465	1,190	2·63
Do. low-caste ...	25,888	78	3·01	19,281	34	1·76	45,169	112	2·47
Mussalmans ... ..	94,975	113	1·18	60,126	41	·68	155,101	154	0·98
Parsees ... ..	24,705	41	1·65	22,753	26	1·14	47,458	67	1·41
Jews ... ..	2,590	6	2·31	2,431	4	1·64	5,021	10	1·99
Native Christians ...	20,040	55	2·74	9,672	15	1·55	29,712	70	2·36
Eurasians ... ..	2,294	2	·87	2,036	2	·98	4,330	4	0·92
Europeans ... ..	8,118	1	·12	3,172	...	...	11,290	1	0·08
Negro-Africans ... ..	90	...	...	56	1	17·85	146	1	6·84
Chinese ... ..	137	...	...	53	...	...	190	...	...
Other and unknown castes ... ..	.....	...	...	.....	...	...	.....	...	...
Total... ..	518,093	1,370	2·63	303,671	566	1·88	821,764	1,936	2·53

Mortality from Bubonic Plague by age periods.

581. The mortality by age periods is most interesting. The highest mortality amongst males occurred at two age periods between 10 and 20 and 25 to 30 years of age, while the highest fatality amongst females occurred from 10 to 14 years of age and from 25 to 29. In both sexes the incidence of mortality was lowest under 5 years of age. It is possible that the low mortality at early periods of life may have been due to imperfect registration and not merely to the concealment of cases but to the difficulty of recognition in cases amongst children.

582. The table printed hereafter shows that the mortality at nearly all periods of life was lower amongst females than males.

*Table showing the number of deaths and the death-rate from Bubonic Plague amongst Males and Females at different age periods in 1896.*

AGES.	MALES.			FEMALES.		
	Population.	Number of Deaths.	Death rate per 1,000 of Population.	Population.	Number of Deaths.	Death rate per 1,000 of Population.
Under 1 year ...	12,427	3	·24	12,864	2	·15
From 1 to 2 years ...	6,619	2	·30	6,884	5	·72
" 2 to 3 " ...	6,893	4	·58	7,250	2	·27
" 3 to 4 " ...	6,868	5	·78	6,564	5	·76
" 5 to 9 " ...	33,969	75	2·20	32,229	66	2·04
" 10 to 14 " ...	47,664	152	3·16	30,242	92	3·04
" 15 to 19 " ...	57,181	180	3·16	33,598	68	2·02
" 20 to 24 " ...	74,160	215	2·89	37,465	70	1·86
" 25 to 29 " ...	72,650	239	3·28	31,282	76	2·42
" 30 to 34 " ...	61,687	161	2·60	27,079	38	1·40
" 35 to 39 " ...	38,190	104	2·72	16,568	32	1·93
" 40 to 44 " ...	38,287	88	2·29	20,182	43	2·13
" 45 to 49 " ...	18,263	49	2·68	9,297	25	2·68
" 50 to 54 " ...	20,825	50	2·40	13,443	19	1·41
" 55 to 59 " ...	7,251	13	1·79	4,565	3	·65
" 60 and over ...	15,659	30	1·91	14,139	20	1·41
Total... ...	518,093	1,370	2·64	303,671	566	1·86

583. The outbreak in the fishing villages of Sewri Koliwada on the north-east of the Harbour foreshore deserves attention and study because of the period of its occurrence and the fatality that attended it. The population is about 1,865 in some 157 dwellings—most of them huts. The buildings were without plinths and had only narrow passages between them, they were without drainage, and had water-pipes close to the huts and even inside some of the dwellings. Outbreak in Sewri Village.

584. The first case occurred on the 2nd of December 1896; the second on the 12th; third on the 15th; fourth on the 17th; fifth on the 19th; sixth on the 20th; seventh on the 21st; eighth on the 21st; ninth on the 24th; the tenth and the eleventh on the 26th. The greatest number of cases occurred on the 18th January 1897. In all 134 cases occurred and 104 deaths. The distribution of a portion of the population during the outbreak is interesting.

*Sewri Koliwadi.*

Number of people before outbreak ...	1,865
" of persons who went to Carli ...	300
" " to Watoojognee ...	302
" " to open fields ...	500
" " to Andheri ...	255
" " to Inar ...	319
" " remained in village ...	85

After the village had been almost vacated, and the people went into the fields and elsewhere, 150 persons died, that is, 46 more than died in the village. The people thought they would have escaped more easily had they remained.



585. I drew attention in a paper read before the Bombay Medical and Physical Society, to a coincidence between the disappearance of cases and the disinfection of a pool of dirty water in this locality:—

Fifty-one deaths occurred; the last death (up to the date of the paper) occurred on the 2nd of February. On that date we had disinfected a salt-water ditch, the banks of which were used for natural purposes and the water for ablution. It is a curious coincidence that after this date, the 2nd of February, on which the stream was disinfected, and all foul matter burnt, not another case occurred. Near the Khada, Professor Hankin found a microbe identical in character with the Bubonic Plague organism.

After this paper was read cases occurred again.

SEWRI KOLIWADI.

Date.	No. of Cases.	Attacks.	Deaths.
1896.			
December 2nd	1	1	1
" 12th	2	1	1
" 15th	3	1	1
" 17th	4	1	...
" 19th	5	1	...
" 20th	6	1	1
" 21st	7, 8	2	1
" 24th	9	1	1
" 26th	10, 11	2	2
" 27th	12, 13	2	2
" 28th	14	1	1
" 30th	15	1	1
" 31st	16	1	1
1897.			
January 4th	17	1	1
" 7th	18, 19	2	2
" 8th	20, 21	2	2
" 9th	22	1	1
" 11th	23	1	1
" 12th	24, 25, 26, 27	4	4
" 15th	28	1	1
" 16th	29, 30, 31	3	3
" 18th	32, 33, 34, 35, 36, 37	6	6
" 19th	38, 39, 40	3	2
" 20th	41	1	1
" 21st	42	1	1
" 22nd	43	1	1
" 23rd	44	1	...
" 24th	45, 46, 47, 48	4	4
" 25th	49	1	1
" 26th	50	1	1
" 29th	51, 52	2	2
" 31st	53	1	1
February 2nd	54, 55, 56	3	1
" 3rd	57	1	1
" 4th	58, 59	2	1
" 5th	60	1	...
" 6th	61, 62	2	...
" 8th	63, 64	2	2
" 9th	65, 66	2	2
" 12th	67, 68	2	1
" 13th	69, 70	2	2
" 14th	71, 72, 73	3	2
" 15th	74, 75, 76	3	2
" 16th	77	1	1
" 17th	78, 79, 80	3	1
" 18th	81, 82, 83	3	2
" 19th	84	1	1
" 20th	85, 86	2	2
Carried over		86	69

## SEWRI KOLIWADI—contd.

Date.	No. of Cases.	Attacks.	Deaths.
1897.	Brought forward ...	86	69
February 23rd ...	87 ...	1	1
" 24th ...	88 ...	1	1
" 25th ...	89 ...	1	1
" 27th ...	90 ...	1	1
March 1st ...	91 ...	1	1
" 2nd ...	92, 93 ...	2	2
" 3rd ...	94, 95 ...	2	2
" 4th ...	96, 97, 98, 99 ...	4	3
" 6th ...	100 ...	1	1
" 7th ...	101, 102 ...	2	1
" 8th ...	103 ...	1	1
" 9th ...	104 ...	1	1
" 11th ...	105 ...	1	...
" 13th ...	106 ...	1	1
" 14th ...	107, 108 ...	2	2
" 15th ...	109, 110, 111 ...	3	2
" 19th ...	112, 113 ...	2	1
" 20th ...	114 ...	1	1
" 21st ...	115, 116 ...	2	1
" 22nd ...	117, 118, 119 ...	3	3
" 23rd ...	120 ...	1	1
" 26th ...	121 ...	1	1
" 30th ...	122, 123 ...	2	2
" 31st ...	124 ...	1	1
April 2nd ...	125 ...	1	...
" 17th ...	126, 127 ...	2	...
" 18th ...	128 ...	1	...
" 21st ...	129 ...	1	1
" 25th ...	130 ...	1	1
" 27th ...	131 ...	1	...
" 29th ...	132 ...	1	...
May 6th ...	133 ...	1	1
" 19th ...	134 ...	1	...
		134	104

## SEWRI KOLIWADI.

Pro. No.	Street.	House No.	Date of Attack and Death. (Roman figures indicate the date of attack, while the italics indicate the date of death.)
1	Sewri Koliwadi ...	95	2-12—6-12
2	Do. ...	374	12-12—15-12
3	Do. ...	403	15-12—16-12 ; 21-12—22-12
4	Do. ...	398	17-12
5	Do. ...	402	19-12
6	Do. ...	413	20-12—23-12
7	Do. ...	401	21-12
8	Do. ...	400	24-12—25-12
9	Do. ...	232	26-12—4-1
10	Do. ...	331	26-12—4-1 ; 28-12—31-12
11	Do. ...	382	27-12—29-12 ; 9-1—13-1
12	Do. ...	394	27-12—1-1
13	Do. ...	348	30-12—3-1 ; 15-1—17-1 ; 16-1—21-1
14	Do. ...	383	31-12—1-1
15	Do. ...	296	4-1—19-1
16	Do. ...	412	7-1—13-1
17	Do. ...	371	7-1—14-1 ; 24-1—26-1
18	Sewri Road ...	157	8-1—11-1
19	Do. ...	376	8-1—11-1
20	Sewri Koliwadi ...	365	11-1—13-1
21	Do. ...	283	12-1—13-1
22	Do. ...	333	12-1—14-1

SEWRI KOLIWADI—*contd.*

Pro. No.	Street.	House No.	Date of Attack and Death. (Roman figures indicate the date of attack, while italics indicate the date of death.)
23	Sewri Koliwadi ...	347	12-2-17-1; 16-1-20-1
24	Do. ...	158	12-1-17-1
25	Do. ...	364	18-1-20-1
26	Do. ...	362	18-1-20-1
27	Do. ...	336	18-1-21-1; 19-1-21-1
28	Do. ...	350	18-1-22-1
29	Do. ...	329	18-1-22-1; 25-1-27-1
		Hut	
30	Do. ...	296.	18-1-23-1
31	Do. ...	377	18-1-27-1
32	Do. ...	334	19-1-23-1
33	Do. ...	372	19-1
34	Do. ...	442	20-1-23-1
35	Do. ...	343	21-1-23-1
36	Do. ...	420	22-1-25-1
37	Do. ...	300	23-1-31-1-2-2
38	Do. ...	381	24-1-27-1
39	Do. ...	360	24-1-27-1; 29-1-31-1
40	Sewri ...	1132	24-1-27-1
41	Sewri Koliwadi ...	344	26-1-27-1
42	Sewri Agripada ...	1085	29-1-1-2
43	Sewri Cross Road ...	1083	2-2; 4-2-7-2; 4-2; 5-2; 6-2; 6-2; 15-2-19-2
44	Sewri Agripada ...	1181	2-2-8-2; 3-2-7-2; 8-2-13-2; 2-3-11-3
45	New Sewri Road ...	205	2-2; 15-2-19-2
46	Sewri Agripada ...	1087	8-2-15-2; 9-2-11-2; 12-2; 12-2-15-2; 13-2-15-2; 18-2-22-2; 20-2-21-2; 20-2-21-2
47	Sewri Cross Road ...	427	9-2-11-2
48	Sewri Agripada ...	1137	13-2-15-2
49	Sewri Koliwadi ...	3217	14-2; 14-2-17-2; 14-2-17-2; 17-2; 17-2
50	Sewri Cross Road ...	247	15-2
51	Sewri Agripada ...	1097	16-2-19-2; 18-2
52	Sewri Cross Road ...	424	17-2-19-2
53	Sewri Agripada ...	1078	18-2-22-2
54	Sewri Cross Road ...	Hut	19-2-21-2; 7-3; 22-3-26-3; 29-4; 6-5-9-5
55	Sewri Agripada ...	1125	23-2-26-2; 2-3-5-3
56	Do. ...	1128	24-2-2-3
57	Do. ...	1092	25-2-27-2
58	Do. ...	Nil.	27-2-1-3
59	Dhakti Sewri ...	372	1-3-6-3; 14-3-23-3; 6-4-12-4
60	Sewri Cross Road ...	433	3-3-10-3; 4-3-8-3; 14-3-16-3
61	Do. ...	1067A	3-3-6-3; 4-3-6-3
62	Do. ...	Field	4-3; 23-3-26-3
63	Do. ...	432	4-3-7-3
64	Do. ...	910	7-3-8-3; 9-4-9-4
65	Sewri Koliwadi ...	416	8-3-11-3
66	Sewri Agripada ...	1140	11-3
67	Sewri Cross Road ...	428	13-3-17-3
68	Do. ...	1068	15-3-16-3; 15-3; 17-4; 18-4
69	Sewri Agripada ...	1138	15-3-18-3; 21-3-27-3; 26-3-29-3
70	Sewri Cross Road ...	627	19-3-24-3; 2-4
71	Do. ...	629	19-3; 20-3-23-3; 21-3; 22-3-24-3; 30-3-31-3; 30-3-1-4
72	Sewri Agripada ...	1133	22-3-24-3
73	Sewri Cross Road ...	441	31-3-1-1
74	Do. ...	561	17-4
75	Do. ...	896	21-4-2-4
76	Do. ...	62A	25-4-27-4
77	Do. ...	563	27-4
78	Sewri Road ...	Open Field	1

536. In the village and groups of buildings—14 huts in all they numbered—around Ambawadi, an outbreak occurred deserving of observation from the progress of the disease. Outbreak in Ambawadi.

## AMBAWADI.

Date.				Cases.	Attack.	Death.
1897.						
January	4	...	...	1	1	1
"	5	...	...	2	1	.....
"	7	...	...	3, 4	2	.....
"	9	...	...	5	1	1
"	10	...	...	6	1	1
"	11	...	...	7, 8, 9	3	2
"	16	...	...	10	1	1
"	17	...	...	11, 12	2	1
"	22	...	...	13	1	.....
"	23	...	...	14	1	.....
"	24	...	...	15, 16	2	.....
"	25	...	...	17	1	1
"	27	...	...	18	1	1
"	28	...	...	19, 20	2	.....
February	2	...	...	21	1	.....
"	3	...	...	22, 23	2	.....
"	4	...	...	24, 25	2	.....
"	5	...	...	26	1	.....
"	6	...	...	27, 28	2	.....
"	7	...	...	29, 30	2	.....
"	17	...	...	31	1	.....
"	18	...	...	32	1	.....
"	19	...	...	33	1	.....
"	22	...	...	34, 35	2	.....
March	3	...	...	36	1	1
"	22	...	...	37	1	1
April	18	...	...	38	1	1

Pro. No.	Street.	House No.	Date of Attack and Death.
			(Roman figures indicate the date of attack, while italic indicate the date of death.)
1	Tank Bander, Ambawadi	15	4-1—7-1; 5-1; 7-1; 25-1—31-1; 28-1
2	Do.	10	7-1; 9-1—12-1; 23-1; 24-1*; 27-1—2-2; 28-1; 24-1*
3	Do.	14	10-1—14-1; 11-1; 11-1—17-1; 17-1; 2-2; 19-2; 17-2
4	Do.	11	11-1—14-1*; 20-1—2-2; 22-1*; 7-2
5	Ghoraydeo Road, 2nd Ambawadi	5	16-1—18-1; 17-1—19-1
6	Ambawadi	2	2-2
7	Do.	13	3-2; 4-2; 7-2
8	Do.	3	4-2; 18-4—20-4
9	Do.	16	5-2
10	Do.	322	6-2
11	Do.	39	6-2
12	Do.	5	18-2
13	Do.	9	22-2; 22-2
14	Do.	Nil.	3-2—5-2; 22-2—23-2

587. The first case occurred on the 4th January ; second on the 5th ; third and fourth on the 7th ; fifth on the 9th ; sixth on the 10th ; seventh, eighth and ninth on the 11th. This was the largest number of cases in any one day. In all 38 cases occurred and 12 deaths. The mortality is so low that evidently a number of suspicious cases are included.

Outbreak in Worli village.

588. The appearance of the disease in the fishing village of Worli on the North-west of the island occurred in a very remarkable way. The disease passed from Parel for some three miles over buildings and appeared first in a dwelling on the outskirts of the village and afterwards in dark huts in the centre of the village. Most of the cases occurred in the centre of the village in the darkest of the huts. Worli village is approached by a narrow road. On the west side of this road there are chawls and a little distance off the road five ranges of chawls ; on the east side open ground and a few bungalows. Up to the time that the first case occurred in Worli village, not a case had occurred in one of these buildings. The disease was carried past them, as I have described it, to a building immediately outside Worli. The village is on the slope of a hill from the rocky summit gently descending to the ocean on one side, and to the Mahim shore on the other. Most of the buildings are huts close together, and a large number had waterpipes inside. Although in this lovely position, looking over the sea in Mahim Bay and on to a sand-strewn shore, it enclosed groups of dwellings into which the rays of the sun never entered, nor the pure sea-breeze.

A village cordon.

589. A sanitary cordon around this village has been described, but the cordon was not maintained. The measures adopted to isolate the village were measures applied by the villagers themselves. They consisted in the villagers objecting, and they enforced their objections so far as strangers, to any person coming into the village from any of the affected districts of the city, and particularly from the Koli localities at Colaba, Mandvi and Mazagon.

590. But during the epidemic the villagers were in daily communication with the city, going backwards and forwards, carrying on their business as usual.

Progress of cases in Worli (K).

591. The first case was a Portuguese girl, aged 12. It occurred on the 1st of December. The 2nd case occurred some distance off (250 yards) on the 11th of December ; the 3rd case occurred in a hut in the village on the 13th ; the 4th and 5th cases occurred in the same house on the same date ; the 6th case occurred on the 14th ; 7th on the 18th ; 8th, 9th and 10th on the 19th ; 11th, 12th, 13th on the 20th ; 14th, 15th, 16th, 17th, 18th and 19th occurred on the 21st ; 20th on the 22nd ; 21st and 22nd on the 23rd ; 23rd and 24th on the 24th ; 25th on the 25th ; 26th, 27th, 28th and 29th on the 26th ; 30th, 31st and 32nd on the 27th ; 33rd, 34th and 35th on the 28th ; 36th, 37th and 38th on the 29th. In all 124 cases occurred and 104 died.

592. The order of occurrence of the cases is shown in the statement printed hereafter.

Hostility of the villagers to the measures adopted.

The people were obstructive and opposed our measures and, although we put up huts and pandals on the foreshore for them to live in, they did not leave their dwelling nor even enter them. They did not use them up to the last ; although, as stated hereafter, a large number of the population left the village in

January. They were most difficult people to deal with, and constantly obstructed or molested our men.

593. While we were disinfecting and attempting to kill the microbes, the people were marching in processions and searching for the *devi* who caused the disease. They would not listen to the excellent advice of Brahmin priests in the temple who tried to persuade them to do as we wanted.

Outbreak in Worli village. Searching for a Devi or spirit.

594. In December the water-supply in or near buildings was cut off, and stand-pipes put up in open positions.

595. In January some 2,800 people left the village and encamped on open land, a little way off, and did not return till March. Amongst the people who were out 18 cases occurred, while after their return in the middle of March, having been away from the village for over two months, not a case occurred even up to the present time.

596. As I have said, about 2,800 people went out of their habitations and encamped on open ground, a little distance away from the village, and some 1,000 went out of Bombay to visit the temple at the Carli Caves. Amongst the people who went to Carli, 11 cases occurred, and all proved fatal. Of the population of the village, some 80 remained in the village all the time during the epidemic and did not go away.

597. In December the mat roofs and tiles were taken off all the buildings, and obstructions to light removed. The floors of the poorer classes of buildings, with the roofs off, and the rooms in the verandahs removed, were open to the sky. The whole village was lime-washed in January.

598. The course of the disease in the village of Naigaum is very interesting. Naigaum has a population of about 3,000 people.

Naigaum cases.

599. The 1st case occurred on the 29th of September ; 2nd on the 21st of October ; 3rd on the 19th of December ; 4th on the 21st of December ; 5th on the 22nd ; 6th on the 30th ; 7th and 8th on the 31st ; 9th and 10th on the 3rd of January ; 11th and 12th on the 8th of January ; 13th on the 17th ; 14th on the 19th ; 15th on the 20th ; 16th and 17th on the 23rd ; 18th, 19th, 20th and 21st on the 25th ; 22nd on the 26th ; 23rd, 24th, 25th, 26th, and 28th on the 27th. From this period the disease decreased. There were 10 houses in which more than one case occurred. In all 114 cases occurred and 58 deaths.

600. Dhakji Purbhu's Wadi contains a number of chawls, the drainage of which runs down to low-lying ground. The chawls are occupied by mill-hands, and people going backwards and forwards to the chawls have to walk through sewage.

Cases in Dhakji Purbhu's Wadi.

601. The 1st and 2nd cases occurred on the 21st January ; 3rd on the 22nd ; 4th, 5th, and 6th on the 24th. On any one date not more than 4 cases occurred. The tiles were taken off the roofs, obstructions to light removed, and the water-supply near the chawls cut off, and stand-pipes erected at a distance. Afterwards the buildings were thoroughly limewashed. In all 46 cases occurred and 32 deaths. The population is a fluctuating one of from 2,000 to 3,000. A fresh case, the last case after a long interval, occurred on the 17th June.

Dharavi Koliwada.

602. The outbreak in the extreme north of the island in Dharavi Koliwada was an interesting one, as it was suggested that the disease had been imported by a Koli, one of the residents who went one night by train to Mazagon to see a relative who was ill from bubonic plague. He remained in Mazagon one night and one day, and returned the next evening, ill with fever, to Dharavi. This case attracted attention, as the 2nd case occurred within 24 hours in the same house. The 1st occurred on the 3rd of February. I am inclined to believe that the disease was not imported into this village by the 1st case observed, and that there was not a connection between the 1st and 2nd cases. The short interval that elapsed between the 1st and 2nd cases, suggests to me that there was no connection between the cases. In the group of villages in this locality, 227 cases in all occurred and 125 deaths.

Population of Worli Koliwada village ... ..	3,989
Number of huts in do. do. ... ..	700
Distance of the house in Worli Koliwada where the first case of bubonic plague occurred from the house where the second case occurred ... ..	250 yards.
Number of cases in Worli Koliwada ... ..	124
Number of chawls on Cleveland Road... ..	5
Number of cases that occurred in these chawls ... ..	9
Number of cases that occurred in Sewri Koliwada ... ..	134
Number of deaths in Sewri Koliwada ... ..	104
Number of huts in Sewri Koliwada ... ..	157
Population of Sewri Koliwada ... ..	1,865
Number of cases that occurred in Naigam village ... ..	114
Number of deaths in Naigam village ... ..	58
Population of Naigam village ... ..	3,000

## DHAKJI PURBHU'S WADI.

Date.	Cases.	Attacks.	Deaths.
21st January 1897 ... ..	1, 2	2	2
22nd " " ... ..	3	1	1
24th " " ... ..	4, 5, 6	3	...
26th " " ... ..	7, 8, 9	3	3
27th " " ... ..	10, 11, 12, 13	4	2
28th " " ... ..	14, 15	2	2
29th " " ... ..	16, 17, 18, 19	4	3
30th " " ... ..	20, 21	2	2
31st " " ... ..	22, 23	2	1
1st February 1897 ... ..	24	1	1
3rd " " ... ..	25, 26	2	2
4th " " ... ..	27, 28	2	1
5th " " ... ..	29, 30	2	2
6th " " ... ..	31, 32	2	1
10th " " ... ..	33	1	1
14th " " ... ..	34, 35, 36	3	2
15th " " ... ..	37	1	1
17th " " ... ..	38	1	1
21st " " ... ..	39	1	...
22nd " " ... ..	40, 41	2	1
23rd " " ... ..	42	1	...
25th " " ... ..	43	1	1
1st March 1897 ... ..	44	1	...
13th " " ... ..	45	1	1
17th June " " ... ..	46	1	1
Total ... ..			32

Pro. No.	Street.	House No.	Roman figures indicate date of attack and italic figures date of death.
1	Dhakji Purbhu's Wadi ...	7	21-1—26-1 ; 27-1—7-2
2	" " ...	16	21-1 ; 24-1
3	" " ...	8	22-1—24-1 ; 27-1 ; 29-1—30-1
4	" " ...	9	24-1
5	" " ...	2	24-1 ; 27-1—29-1
6	" " ...	30	26-1—30-1
7	" " ...	4	26-1—2-2
8	" " ...	38	26-1—30-1 ; 4-2—6-2 ; 4-2 ; 6-2 ; 13-3—14-3
9	" " ...	9	27-1 ; 28-1—30-1 ; 28-1—31-1 ; 30-1—30-1, 31-1 ; 14-2—16-2
10	" " ...	39	29-1 ; 31-1—1-2
11	" " ...	23	29-1—1-2 ; 10-2—12-2 ; 17-2—19-2
12	" " ...	1	29-1—31-1 ; 1-3
13	" " ...	Nil.	30-1—2-2 ; 22-2—26-2
14	" " ...	68	1-2—3-2
15	" " ...	17	3-2 ; 3-2 ; 21-2
16	" " ...	19	5-2—7-2
17	" " ...	28	5-2—7-2 ; 14-2—15-2
18	" " ...	35	6-2—7-2
19	" " ...	32	14-2
20	" " ...	33	15-2—22-2
21	" " ...	24	22-2 ; 23-2
22	" " ...	18	25-2—28-2
23	" " ...	37	17-6—18-6

## NAIGAUM.

Date.	Cases.	Attacks.	Deaths.
29th September 1896 ... ..	1	1	...
21st October " ... ..	2	1	...
19th December " ... ..	3	1	...
21st " " ... ..	4	1	1
22nd " " ... ..	5	1	1
30th " " ... ..	6	1	1
31st " " ... ..	8	2	2
Carried forward ...			5



## Naigaum--contd.

Date.	Cases.	Attacks.	Deaths.
Brought over ...			5
3rd January 1897 ...	9, 10	2	...
8th " " ...	11, 12	2	2
17th " " ...	13	1	...
19th " " ...	14	1	1
20th " " ...	15	1	1
23rd " " ...	16, 17	2	...
25th " " ...	18, 19, 20, 21	4	1
26th " " ...	22	1	1
27th " " ...	23, 24, 25, 26, 27, 28	6	6
28th " " ...	29, 30	2	1
29th " " ...	31	1	1
30th " " ...	32, 33, 34, 35	4	...
31st " " ...	36, 37, 38, 39, 40, 41	6	2
1st February 1897 ...	42	1	1
2nd " " ...	43, 44	2	1
3rd " " ...	45, 46, 47	3	1
4th " " ...	48, 49, 50, 51, 52	5	1
5th " " ...	53, 54, 55, 56	4	3
8th " " ...	57	1	...
9th " " ...	58, 59	2	...
10th " " ...	60, 61	2	2
14th " " ...	62	1	1
15th " " ...	63, 64, 65, 66	4	4
16th " " ...	67	1	1
17th " " ...	68, 69, 70	3	2
18th " " ...	71	1	...
19th " " ...	72	1	...
20th " " ...	73	1	1
21st " " ...	74	1	1
23rd " " ...	75	1	...
24th " " ...	76	1	...
26th " " ...	77	1	...
1st March 1897 ...	78, 79, 80	3	3
2nd " " ...	81, 82	2	2
5th " " ...	83, 84, 85, 86, 87	5	4
7th " " ...	88	1	...
8th " " ...	89	1	...
9th " " ...	90, 91, 92, 93	4	2
10th " " ...	94, 95	2	...
14th " " ...	96	1	1
18th " " ...	97	1	...
19th " " ...	98	1	1
23rd " " ...	99	1	1
24th " " ...	100	1	1
29th " " ...	101	1	1
13th April 1897 ...	102	1	...
14th " " ...	103, 104	2	...
15th " " ...	105	1	...
16th " " ...	106, 107, 108	3	...
19th " " ...	109	1	...
23rd " " ...	110	1	1
24th " " ...	111, 112	2	1
26th " " ...	113	1	...
28th " " ...	114	1	...
Total ...			58

## NAIGAUM.

Pro. No.	Street.	House No.	Roman figures indicate date of attack and italic figures date of death.	
1	Naigaum Cross Road	...	9	29-9 ; 23-3—26-3 ; 24-3
2	Do.	...	A-35	21-10
3	Naigaum Road	...	24	19-12 ; 21-12—22-12 ; 22-12—22-12
4	Do.	...	385	30-12—1-1 ; 31-12—1-1
5	Do.	...	587	31-12—31-12
6	Naigaum Cross Road	...	208	3-1 ; 3-1 ; 3-2—5-2
7	Do.	Union Mill.		8-1—9-1
8	Naigaum Road	...	50	8-1—10-1 ; 27-1—28-1
9	Naigaum Cross Road	...	40	17-1 ; 19-1—26-1 ; 20-1—28-1 ; 23-1 ; 25-1 ; 25-1 ; 25-1 ; 27-1—28-1 ; 30-1
10	Do.	...	204	23-1
11	Do.	...	43	25-1—27-15 ; 27-1—28-1
12	Naigaum Road	...	48-49	26-1—27-1
13	Do.	...	208	27-1—29-1
14	Do.	...	A-208	27-1—31-1
15	Naigaum Cross Road	...	26	27-1—29-1
16	Do.	...	253	28-1 ; 30-1 ; 4-2
17	Do.	Hut.		28-1—3-2 ; 15-2—17-2 ; 26-4
18	Do.	...	255	29-1—1-2 ; 31-1—1-2 ; 2-2—6-2 ; 10-2 —17-2
19	Do.	...	143	30-1
20	Do.	...	46	30-1 ; 31-1
21	Do.	...	Nil.	31-1 ; 4-2 ; 8-2 ; 9-2 ; 18-2 ; 19-2
22	Do.	...	209	31-1
23	Naigaum field	...	Nil.	31-1
24	Naigaum Cross Road	...	37	31-1—2-2
25	Naigaum Road	...	Nil.	1-2—7-2 ; 10-3
26	Naigaum Cross Road	...	42	2-2
27	Do.	...	254	3-2
28	Do.	...	576	3-2
29	Do.	...	300	4-2
30	Naigaum Road	...	Hut.	4-2—8-2 ; 4-2 ; 5-2—7-2 ; 5-2 ; 15-2 —21-2 ; 1-3—7-3 ; 2-3—6-3 ; 14-3— 22-3 ; 14-4 ; 15-4—17-4
31	Naigaum Cross Road	...	252	5-2—6-2
32	Naigaum Road	...	405	5-2—8-2 ; 17-2—21-2 ; 17-2—21-2
33	Do.	...	53	9-2
34	Do.	...	51	10-2—13-2
35	Do.	...	49	14-2—18-2
36	Do.	...	620	15-2—18-2 ; 5-3—6-3 ; 9-3—10-3 ; 9-3—10-3 ; 14-4
37	Do.	...	241	15-2—19-2 ; 17-2 ; 21-2—22-2
38	Do.	...	242	16-2—19-2
39	Do.	...	246	20-2—22-2
40	Do.	...	232-233	23-2 ; 24-2 ; 26-2
41	Do.	...	256	1-3—14-3
42	Do.	...	213	1-3—2-3
43	Do.	...	409	2-3—5-3 ; 8-3
44	Naigaum Road (Booran Tank).	...	A-105	5-3—6-3 ; 5-3—6-3 ; 5-3—8-3
45	Do.	...	105	5-3
46	Naigaum Road	...	408	7-3—8-3
47	Do.	...	272	9-3
48	Do.	...	56	9-3
49	Do.	...	259	10-3 ; 19-3
50	Do.	...	496	18-3
51	Do.	...	600	29-3—31-3 ; 23-4—25-4 ; 28-4
52	Do.	...	61	13-4 ; 16-4 ; 16-4 ; 24-4—25-4
53	Do.	...	497	16-4
54	Naigaum Cross Road	...	A-414	19-4 ; 24-4

## WORLI KOLIWADA.

Pro No.	Street.	House No.	Roman figures indicate date of attack and italic figures date of death.
1	Worli Koliwada ... ..	6	1-12-10-12
2	Do. ... ..	536	11-12-14-12
3	Do. ... ..	Nil.	18-12-16-12; 19-12-22-12; 20-12-22-12; 20-12-22-12; 21-12; 21-12-25-12; 3-1-9-1; 5-1-6-1; 6-1-7-1; 6-1; 7-1-8-1; 14-1-16-1; 14-1-21-1; 15-1-18-1; 16-1-17-1; 22-1; 27-1-30-1
4	Do. ... ..	335	13-12-18-12; 13-12-18-12; 24-12-25-12; 24-12-27-12
5	Do. ... ..	537	14-12-16-12
6	Do. ... ..	534	18-12-20-12; 21-12; 21-12-25-12; 7-1
7	Do. ... ..	40	19-12-22-12; 19-12-23-12
8	Do. ... ..	148	20-12-27-12
9	Do. ... ..	L-147	21-12-23-12
10	Do. ... ..	33	21-12-23-12
11	Do. ... ..	147	22-12; 23-12-25-12
12	Do. ... ..	13	23-12-24-12; 27-12-3-1; 1-1-3-1
13	Do. ... ..	532	25-12-30-12; 26-12-30-12
14	Do. ... ..	14	26-12-23-12; 26-12-23-12; 27-12; 29-12-30-12
15	Do. ... ..	266	26-12-31-12
16	Do. ... ..	195	27-12-31-12
17	Do. ... ..	142	28-12-30-12
18	Do. ... ..	407	28-12-4-1; 2-1-4-1; 3-1
19	Do. ... ..	475	28-12-12-1
20	Do. ... ..	15	29-12
21	Do. ... ..	533	29-12-2-1
22	Do. ... ..	37	31-12-2-1
23	Do. ... ..	116	31-12-2-1; 6-1-10-1
24	Do. ... ..	498	31-12-2-1
25	Do. ... ..	141	1-1-3-1
26	Do. ... ..	131	1-1
27	Do. ... ..	198	1-1-14-1; 3-1-5-1
28	Do. ... ..	45	2-1-3-1
29	Do. ... ..	192	3-1-10-1
30	Do. ... ..	136	4-1-6-1; 4-1-6-1; 11-1-14-1; 19-1-26-1
31	Do. ... ..	166	5-1-6-1
32	Do. ... ..	200	5-1-9-1
33	Do. ... ..	197	6-1
34	Do. ... ..	77	6-1-10-1
35	Do. ... ..	387	7-1-9-1
36	Do. ... ..	262	8-1-10-1
37	Do. ... ..	101	8-1-13-1; 14-1-14-1
38	Do. ... ..	183	9-1-12-1
39	Do. ... ..	Shed.	9-1-11-1; 19-1
40	Do. ... ..	231	10-1-16-1; 10-1
41	Do. ... ..	30	10-1-17-1
42	Do. ... ..	444	11-1-15-1
43	Do. ... ..	440	13-1-17-1
44	Do. ... ..	502	13-1-17-1
45	Do. ... ..	239	13-1-19-1; 13-1-19-1
46	Do. ... ..	C-200	15-1
47	Do. ... ..	278	15-1-17-1
48	Do. ... ..	Hut.	16-1-22-1; 20-1
49	Do. ... ..	331	18-1
50	Do. ... ..	361	19-1-21-1

Worli Koliwada—*contd.*

Pro. No.	Street.	House No.	Roman figures indicate date of attack and Italic figures date of death.
51	Worli Koliwada ... ..	288	20-1 ; 21-1 ; 21-1
52	Do. ... ..	Open ground.	22-1—24-1
53	Worli Sluice Road ... ..	Field.	22-1—27-1
54	Worli ... ..	Do.	27-1—28-1
55	Worli Cleveland Road ... ..	E-341	29-1—2-2 ; 29-1 ; 2-2—14-2 ; 14-2 ; 14-2—17-2 ; 15-2
56	Do. ... ..	2	*4-2
57	Do. ... ..	A-341	*3-2—9-2 ; 14-2—18-2
58	Worli Koliwada ... ..	78	6-2—12-2
59	Do. ... ..	313	10-2—14-2
60	Do. ... ..	520	11-2—18-2
61	Do. ... ..	C-341	13-2—20-2 ; 25-2
62	Do. ... ..	Hut.	14-2—17-2
63	Do. ... ..	169	15-2—17-2
64	Do. ... ..	128	22-2—26-2
65	Worli Cleveland Road ... ..	Nil.	22-2—27-2
66	Worli Koliwada ... ..	Nil.	25-2
67	Do. ... ..	118	26-2—28-2
68	Do. ... ..	Nil.	28-2—5-3
69	Do. ... ..	Hut.	4-3
70	Do. ... ..	541	3-4

603. 297 cases of Bubonic Plague were treated in the Arthur Road Hospital up to the end of the year, and the mortality was very low, considering how hopeless on admission many of the cases sent to hospital were, and that some of them had neither received care nor food after their illness commenced till they were admitted into hospital, having been sent by inspection parties from the City to Arthur Road in the first period, and generally to Grant Road Hospital in the last period, the latter being the most convenient. Favourable results of treatment in the Arthur Road Hospital.

604. The proportion of mortality amongst Christians admitted into Arthur Road Hospital may be taken as the average result likely to be obtained from treatment, although even amongst Christians some cases were found that had been neglected or who, being without any one to care for them, were sent to hospital. The results, however, were favorable, 48 per cent. recovering, and although not so good as in the European Hospital, are strong evidence, it must be admitted, of the value and excellence of the Municipal Hospital. The Christians were all poor and many of them strangers, and yet 48 per cent. recovered.

*Table showing the Number of Cases of Bubonic Plague admitted into the Arthur Road Hospital in 1896.*

Disease.	Admitted.	Recovered.	Died.	Percentage of Mortality.
Bubonic Plague ... ..	297	98	199	67.00

Table showing the Number of Cases of Bubonic Plague admitted into the Arthur Road Hospital from September 1896 up to June 1897 and the Rate of Mortality.

Months.	Number admitted.	Died with- in 24 hours.	Died with- in 48 hours.	Total Deaths.	Recovered.	Percentage of Total Mortality.	Percentage of Mortality, excluding the deaths within first 24 hours.
1896							
September ...	} 88	17	10	46	42	52.23	40.84
October ...		9	3	18	9	66.67	50.00
November ...		27	60	63	135	47	74.12
December ...	182						
1897							
January ...	277	90	43	191	86	69.00	54.00
February ...	365	130	46	298	67	81.64	71.48
March ...	193	54	34	130	63	67.35	54.28
April ...	60	17	10	34	26	56.66	39.53
May ...	26	7	1	10	16	38.46	15.78
June... ...	42	2	1	6	36	14.28	10.00
Total ...	1,260	386	211	868	392	68.88	38.25

\* As only 8 cases were admitted in the end of September, they have been included in October cases; of these 2 recovered and 1 died.

Table showing the Mortality from Bubonic Plague by Classes arranged by Sex in Arthur Road Hospital.

Hindus.

	Admitted.	Recovered.	Died.	Percentage of Mortality.
Males ... ..	172	71	101	58.72
Females ... ..	50	21	29	58.00
Children ... ..	33	17	16	48.48
Total ...	255	109	146	57.25

Musulman.

	Admitted.	Recovered.	Died.	Percentage of Mortality.
Males ... ..	24	11	13	54.16
Females ... ..	4	3	1	25.00
Children ... ..	2	.....	2	100.00
Total ...	30	14	16	53.33

Christians.

	Admitted.	Recovered.	Died.	Percentage of Mortality.
Males ... ..	24	10	14	58.33
Females ... ..	5	3	2	40.00
Children ... ..	2	2	.....	00.00
Total ...	31	15	16	51.61

Table showing the Number of Cases of Bubonic Plague according to Sex admitted into the Grant Road Hospital and the Rate of Mortality.

Admitted.			Recovered.			Percentage of Mortality.		
Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
260	114	374	108	41	149	58.47	64.04	60.16

Table showing the Number of Admissions into the European General Hospital from Bubonic Plague and the Rate of Mortality.

Admitted.	Died.	Percentage of Mortality.
95	37	38.94

Table showing the Percentage of Mortality amongst Cases admitted into the Parel Hospital.

Mortality.	Men.	Women.	Children.	Boys.	Girls.
64.5	68.6	71.0	52.8	42.5	64.3

Table showing the Number of Admissions into the Hindix Fever Hospital from the 20th of January up to the end of June and the rate of Mortality.

Months.	Admitted.	Recovered.	Died.	Percentage of Mortality.
January ...	4	...	4	100.0
February ...	73	13	55	75.3
March ...	135	36	99	73.3
April ...	101	21	80	79.2
May ...	17	2	15	88.2
June ...	1	...	1	100.0
Total ...	231	77	254	76.7

In 196 cases buboes were observed.

Table showing the Proportion of Buboes to Cases in the Cutchi Memon Hospital.

		In the	
		Beginning.	Later.
With Buboes ...	A. { Mild form without febrile symptoms	2%	5%
	Do. with do. do.	1,,	20,,
Without Buboes ...	B. Severe form ...	95,,	65,,
	{ With lung complication ...	1,,	5,,
	{ Without lung complication ...	1,,	5,,

Table showing the Number of Cases with External Glandular Enlargements admitted into the Wari Bunder Hospital.

Femoral.	Inguinal.	Cervical.	Axillary.	Cervical and Inguinal.	None.
15	10	9	6	4	6

Table showing the Number of Cases of Bubonic Plague admitted into the Dharavi Plague Hospital during April and May 1897.

Admitted.	Died.	Percentage of Mortality.
70	31	42.88

Table showing the Number of Cases of Bubonic Plague admitted into the Parsee Hospital from the 18th of December 1896 to the 31st of August 1897 and the Rate of Mortality.

Admitted.	Recovered.	Died.	Percentage of Mortality.
321	130	185	57.63

Hospital results, various.

605. The results of treatment in different hospitals varied very much. For instance, 50 cases were admitted in the Julai or Weavers' Hospital between the 10th of April and the 5th of July, the patients were treated by a "Hakim" in this hospital shed, and out of the 50 only 22 died. This is a very remarkable result. Although the hospital was under the supervision of Dr. Deane, the District Medical Officer, the cases were treated by the Hakim. An explanation has been suggested to me that the large proportion of recoveries was due to the fact that the patients were very much let alone, and, except by their friends, very little disturbed. However, there is the fact that, out of 50 cases, some of which Dr. Deane told me were of a very bad type, only 22 died. The patients were Mussulman, but very poor, and the Julais are a class amongst whom cases of Famine Fever sometimes appear. It may be that the large proportion of recoveries was due to the patients being Mussulman, a people who have shown great powers of resisting the disease.

606. Very few cases occurred round hospitals. Two cases occurred in the servants' quarters of the Technical Institute at the back of the Parsee Fever Hospital.

Yersin's serum.

607. I am afraid we had not entertained the hopes that had been formed in England of the value of Dr. Yersin's serum. In fact, the expectations formed in England were based on hopes that have not been realized from any system of treatment in any disease. We could only hope, although we had little faith, that the expectations had been well founded and would be realized. We were only too anxious to give a trial to any treatment and an opportunity to any medical man.

Parsee Hospital, Yersin's serum in use.

608. Dr. Thomson reported 27 cases treated by Dr. Yersin's serum in Parsee Hospital. He excluded four as not being fair cases by which to judge the treatment. Of the 23 cases, 13 died and 10 recovered.

609. A very interesting case of a school boy sent to Parsee Hospital from Dburjee Dongri Street occurred. He had been inoculated with prophylactic serum on the 24th of April, and on the 29th symptoms of Bubonic Plague appeared. He had two tubercles—one on the left side and one on the left arm. The case turned out to be a mild one, and he recovered and was discharged from hospital on the 7th of May.

610. Professor Lustig, who had prepared a curative serum, treated a <sup>Prof. Lustig's</sup> <sub>serum.</sub> small number of cases in the Arthur Road Hospital. Although the results were very favorable, the cases are too few in number to justify any conclusions being drawn from them. Professor Lustig thus describes the serum:—

“ After many trials we were able to procure from plague bacilli cultivated in “ agar,’ of which the virulence was known, a substance free from bacteria, which “ inoculated in animals in sufficient quantity is extremely poisonous, and in small “ quantities makes them quite refractory to the most dangerous forms of infection. “ From the animals vaccinated two or three times with this substance in small doses “ and at intervals of two days, we can obtain a serum with decidedly curative and “ preservative action.” Seven (7) cases were treated by Professor Lustig, of whom 6 recovered and 1 died. In other cases inoculated, the results were not so favourable, and gave a mortality of over 40 per cent.

## HOSPITALS OPENED.

	Hospitals.	Date of use.
M	Arthur Road Municipal Hospital ... ..	From commencement.
G	St. George's European General Hospital ... ..	30th September 1896.
P	Arthur Road Jain Hospital ... ..	11th December "
P	Parel Road Parsi Hospital ... ..	23rd " "
P	Port Trust Hospital ... ..	31st January 1897.
P	Modikhana Hospital for Sahebs' servants ... ..	18th February "
G	Parel Government House ... ..	4th March "
M	Grant Road Municipal Hospital... ..	10th " "
P	Pilot Bunder Hospital ... ..	12th " "
P	Connaught Road Hindoo Hospital ... ..	15th " "
P	Immanwada Umarkhadi by Aga Abdool Hussein for Mogals ... ..	17th " "
P	Clive Road for Dussa Sa Bunias... ..	18th " "
P	Mint Road by Govindji Thakarsi Moolji for Bhattias ... ..	19th " "
P	Charni Road by Adamji Pirbhoy for Borah Community. Sion Hospital ... ..	23rd " "
P	Foras Road Police Hospital ... ..	24th " "
P	Satri Sarang Street ... ..	25th " "
P	Musjid Street Mahomedan Hospital ... ..	25th " "
G	Wadi Bunder Hospital ... ..	26th " "
P	Mahim Hospital ... ..	27th " "
P	Tantanpura Street Khoja Hospital ... ..	28th " "
P	Jackeria Musjid Street for Cutchi Memon ... ..	29th " "
P	Modikhana Hospital ... ..	31st " "
P	Parel Road Jain Hospital ... ..	1st April "
P	2nd Pinjrapole for Marwaris ... ..	1st " "
P	Worli Hospital ... ..	1st " "
P	Kolsa Street by Haji Cassum Miita for Memon Sunees. DeSouza Street for Lohana, Cutchi, Halari, Goggari Community ... ..	1st " "
P	Reay Road Hospital ... ..	1st " "
P	Bapukhote Street for Khatri Mahomedan ... ..	1st " "
P	Dharavi Private Hospital ... ..	4th " "
P	Haji Cassum Jusab Hospital, Rangari Moholla... ..	8th " "
P	Ripon Road Julai Hospital ... ..	10th " "
P	Telegu Hospital ... ..	14th " "
P	Nagdevi Street General Mahomedan Community ... ..	15th " "
P	Memon Moholla Street for Hali Memon ... ..	18th " "
P	Narial Wadi Hospital ... ..	25th " "
P	Connaught Road Khoja Hospital ... ..	26th " "
P	Don Tad Cross Lane Hospital ... ..	27th " "
P	Bhoiwada, Bhufeshwar, for Marjadi Vishnav Bunia ... ..	1st May "
P	Falkland Road Hospital ... ..	7th " "



Recurrence of the disease.

611. Only three cases of a recurrence of the disease and of second attacks have been reported to me. Two of the cases I reported in a paper read before the Medical and Physical Society, and they are also referred to in a paper by Dr. Herbert :—

“ Mrs. E. ( Flora Benjamin )—1st attack at Hongkong on the 24th June 1894, Sunday. ( Previous to my getting ill, my Ayah got bubonic fever on the 21st or 22nd of June ; she was removed by her relatives, and she died. ) I got ill on the evening of the 24th ( Sunday. ) I got fever, accompanied with vomiting and severe pain in the head. Temperature 105. Dr. Jardine of Hongkong saw me on the morning of the 25th ( Monday ). He prescribed for me a purgative powder and mixture. On the 26th ( Tuesday ) I felt better, and I could walk for about two or three hours, when I got bad again—this time with a severe chill—and temperature rose again. On this day Dr. Jardine saw me again and prescribed. He continued seeing me daily twice till the 29th, when I got very bad and had severe pain in the neck ( left side ). On Saturday ( 30th ) two consultants, Dr. Hastings and Dr. ———, came with Dr. Jardine, and they removed me forthwith to hospital ( isolation ). I don't remember now anything for about a week. The swelling in the neck was very painful. I could not move my neck. I was then operated upon the neck ( the scar is there ). Six days afterwards Drs. Lawson, Morry, Newks and Penny saw me at the hospital, and operated on me again. From this date I gradually recovered, being regularly and kindly attended by the Doctors till the 8th day of August, when I left the hospital quite well.”

#### *Recurrence.*

“ On Sunday, the 6th December 1896, I had a severe pain in the head ; this continued for two days, with slight fever and general pains. I took castor-oil. Bowels opened seven times. On Tuesday I got severe chills with vomiting and fever. Dr. L. Godinho saw me. Temperature 105 ; vomiting incessant. Linseed and mustard ordered to the stomach. The fever remained high all day. Quinine mixture given. On Wednesday I complained of pain in the right groin. Dr. Godinho examined me and found a glandular swelling there ( femoral region ). The gland could be felt—good-sized marble. Dr. Godinho saw me twice on Wednesday. The fever continued—104 to 105. On Friday he saw me again, and changed mixture. The temperature now fell ( Friday ) to 103 and gradually went down to Sunday, when I felt nearly well, the swelling and pain getting less and disappearing. The lymphatics were painful.”

#### *Case No. 2.*

“ 30th September 1896.—Mahomed Allybux Kadirally ( age 53 ), Samuel Street, No. 197, second floor.

“ 3rd day.—Left parotid bubo, size of a pigeon's egg, tender. Pulse 150 ; respiration 44 ; temperature 105. Shivering delirious ( bubo, second day ). 40 minims of medretine given and 10 minims of liq. hydrarg. perchl. every two hours. Calomel gr. ii stat. Ice to the head ; 2 powders given.

“ 31st October.—Restless, 3 motions. Temperature 103; pulse uncountable, respiration 56; bubo more painful and tender. Delirious. Medretine given. Phenacetin and soda salicylas every two hours, as necessary.

“ 1st November.—Pulse 180; respiration 44; temperature 103.5. Delirious; sleep disturbed; right lung congested. Had one motion. Had 3 powders and medretine given, oz. ii in 24 hours. Mixtures, stimulants and expectorants.

“ 2nd November.—Bubo enlarging and painful; pulse 130; respiration 40; temperature 102.2. No headache; lung clear; had one motion. Treatment same.

“ 3rd November.—Temperature 101; pulse 132; respiration 33. A little better. Medretine given every two hours, and ext. carnis and rum every four hours.

“ 4th November.—Temperature 102.2; pulse 144; respiration 40; bubo subsiding; right parotid gland appears tender; medretine every four hours; ext. carnis and rum every four hours.

“ 6th November.—Temperature 100; pulse 140; respiration 40; lungs a little congested.

“ 8th November.—Temperature 99; pulse 128; respiration 36.

“ 15th November.—No fever; bubo suppurated; pulse 112.”

#### *Recurrence.*

“ 2nd December.—Temperature 105; respiration 40; pulse 144. Very delirious and starting in bed. Over left parotid gland much swollen and very tender. Liq. hyd. per m. xv every two hours.

“ 3rd December.—Temperature 104; pulse 160; respiration 60.

“ 4th December.—Temperature 104; respiration 40; pulse 102; delirium less.

“ 5th December.—Temperature 100; respiration 40; pulse 108; delirium less.

“ 6th December.—Doing well.

“ *N.B.*—Allibux Kadratally, age 50 (same house), suffered from bubo 30th October 1896; died 3rd November 1896. Femoral bubo. (Evidently a near relative (father?) of the boy. From the name I infer him to be the father.”)

#### *Case No. 3.*

The patient, Mr. C. T., an Inspector in the Bombay Customs House, a Bania by caste, age 27, was attacked first in February 1897; temperature rising to 105 and a gland in the left femoral region becoming enlarged and painful. Under treatment the gland subsided and the fever disappeared in a week; after

that he enjoyed perfect health for nearly two months, when he had a second attack and the same gland again became enlarged and painful. This second attack can be traced to his nursing and almost living in the same house with a plague patient at Matoonga. On this occasion the gland suppurated and was removed by an operation. The patient made a very slow recovery and was finally discharged cured after living for more than two months in the hospital.

The results of intemperance in a ward boy.

612. A very curious case of a ward boy occurred in the Grant Road Hospital. He had been caught drinking the dregs of stimulants given to the patients; and notwithstanding every prohibition and care, he secretly continued to do so. He contracted the disease and died—a not unexpected effect of his intemperance.

Difficulty of obtaining information of cases before death.

613. The real difficulty during the epidemic was to get information of cases before they died. Even to find ambulance attendants was difficult. We had been trying for a long time to find men to accept employment as ambulance attendants and to remove the sick from houses to the ambulances, but we had great difficulty for a long time in finding any man to accept employment.

Everyone on whose premises any one without friends died from bubonic plague seemed to think that it was our duty and not their own to remove the body, and people, who could have made arrangements just as well as we could, used to write to us to arrange for the immediate disposal of dead bodies. Our Inspectors had, in addition to working all day, to go out at night, and were sometimes kept up all night in making arrangements for the removal of the sick or the dead.

Removal and disposal of dead not interrupted.

614. Neither the removal nor disposal of the dead was interrupted. Our Inspectors had to act as undertakers and remove the dead, because no one else would remove dead bodies unclaimed and uncared for. Often, in the middle of the night, they were summoned to remove the dead, not infrequently dead servants who were abandoned even by their own masters. This is what happened on one occasion. A coachman in the house of A was ill and died. A came to know of it. He ordered the servants to remove the dead body. The servants refused and ran off. A telephoned to us and to Inspector Desmier. Inspector Desmier went there and found a dead body, and no one near it. The grooms had left the horses as they were and there was no one to look after them. The residence was deserted, and Inspector Desmier had to bring men to carry the dead body away. The only claims which some, but a very few I am glad to say, of the people seemed to recognize were the claims of relationship, yet it was not from fear of the disease; it was the influence of the panic spirit even after cause of panic had passed.

Cremation of all Hindu dead.

615. All unclaimed Hindu dead were cremated by the Health Department. It was fortunate that none of the people engaged in the disposal of the dead suffered. Had the grave diggers and the low caste cemetery men become panic-stricken, a frightful state would have come to pass; but not only did they remain at work, but they did treble work and did not even complain. The grave-diggers behaved courageously in not deserting their duties, and they deserve well of us. They are deserving of reward.

Mr. Cuffe gave the Health Department much assistance in making arrangements for the cremation of the dead on the north fore-shore of Malim.

616. There was a rumour at one time that there had been an interruption in the disposal of the dead at the Towers of Silence. I ascertained from enquiries that there was no truth in this rumour.

617. It is well to put on record some of the more prominent external appearances observed in cases of death from bubonic plague. I circulated the following instructions to medical men to guide them in examining dead bodies :—If the position of the body has not been disturbed after death, it will be found on either side, the knees flexed, the head leaning towards the chest, and thumbs pointing towards the palms. Fixed anxious expression, sunken muddy aspect in the eyes, with a peculiar and unusual lustre, the pupils being dilated, the lids half closed. The complexion is opaque and dingy, the skin dry ; if death has been recent, the forehead and hands will be cold and clammy. If there are no distinct buboes in the usual localities, other lymphatics should be carefully examined. *Rigor mortis* is delayed, and there is a softness and want of cohesion in the fibres of the muscles. Occasionally when death occurs during delirium or convulsions, there may be some distortion of the features, in which case if the patient dies when on the back, the head is thrown to either side and the legs separated. If the tongue can be examined it will give valuable information in the early period ; it is slightly swollen with a white or yellowish fur, towards the centre it glistens, towards the tip and edges it is clean. In the later stage it is increased in size, with a yellowish or brown fur, dry, cleft and horny on the surface ; and a red streak down the centre. In cases of lung complications, it will be seen that the conjunctivæ are injected, the complexion of a blush, livid, dusty hue, and a certain amount of sputa around the lips, in addition to the other appearances described. The general condition of the body is shrunken and collapsed.

The posture in which rats or mice died of the disease was also very characteristic.

618. In regard to segregation, Europeans accustomed to leave home in advocating it have to think of the feelings of the people towards segregation and to remember that, to a people not accustomed to go far from home or to live amongst strangers, life in an hospital amongst strangers has many terrors.

619. Children even, when accompanied by their parents or their relatives, felt the anguish of removal as if they were being taken to a place of torture rather than to an hospital. Scientific instruments for the relief of suffering were in the eyes of the mass of the people instruments which might be used for torture. In considering the attitude of the people towards compulsory segregation and, while forming a judgment on their behaviour, the measure must be looked at from the point of view of the friends of the people who were removed to hospital.

We have here seen the disease chiefly treated, and I believe with a great measure of success, by measures of house disinfection in which I include the removal of obstructions to the entrance of light and air.

620. The measures of segregation adopted extend over two periods :

- I. From September up to the beginning of April, when (a) the segregation of all who could not be properly cared for in their own homes was insisted on ; and (b) when a large number of people were removed from infected buildings :
- II. From the beginning of April, about which time the operations of the Plague Committee began up to June, when (a) segregation on a larger scale was attempted and a number of cases were removed to hospital, and (b) when a smaller number of healthy people were removed from infected buildings.

621. The disinfection in the first period was applied to the whole building, as well as to the place affected. The disinfection in the second period was confined at the time to the place affected.

Cases amongst the Conservancy establishment treated differently to the rest of the population.

In neither period was it attempted to treat the few cases amongst scavengers and halalkhores in the same manner as cases in the rest of the population. The sick in these classes were sometimes, but not always, placed in rooms at one end of the building they lived in, and their friends came to see them and went away as they liked. We erected huts for their use, but the huts were seldom used. The measures were sufficient, for in Municipal chawls occupied by scavengers and halalkhores few cases occurred. That is the proof—the proof necessary of the success of the measures. In a chawl in Kamathipura, occupied by 800 people, in the midst of the most affected area, up to the end of the year, only one doubtful case occurred ; yet these chawls are much crowded, as many as 7 men, women and children to each room. While the people living in municipal chawls suffered lightly, the same class living in the ordinary buildings of the city close to the municipal chawls suffered as the rest of the population. The policy from the first was based on the right principle of removing to hospital the poor living in ill-ventilated and crowded buildings. If that policy was successful in the case of municipal scavengers and halalkhores, it must be the right policy in the case of the general population. If in one group of buildings fairly ventilated, although overcrowded and occupied by one class, cases can be treated with success and without danger to the healthy, then it may be assumed that in other buildings, equally well ventilated and occupied by other classes, cases can equally well be treated with safety.

Escape of scavengers from the disease.

622. I have referred to the extraordinary freedom of the halalkhores and scavengers living in municipal chawls, but a similar immunity has been observed in the case of disreputable women living in many portions of the City. Dr. Rogers Pasha and Professor Bitter, who examined with me the municipal chawls or barracks in Kamathipura and the houses of the disreputable classes in the same localities, agreed that the conditions of better ventilation and less overcrowding were the conditions in which these buildings differed from the houses around them. The Leper Asylum in Matunga has had an extraordinary immunity from the disease. In the Island only one case amongst lepers has been reported.

Currents of air fatal to the disease.

623. The organism does not seem to be able to develop virulently or to survive where there are free currents of air, and hence it passes by or little affects well-ventilated buildings.

624. The measures for the prevention of the disease that have been found most efficient are the removal of all obstructions to the admission of light and air, and the thorough cleansing and disinfection of the inside of buildings. Measures of prevention.

625. When the disease is described as a "filth" one the sense in which the word "filth" is used must be defined. The "filth" condition in this city that has most influenced the disease has been insufficient ventilation of buildings, and hence the measures that have had most direct effect on the progress of the disease have been directed to the inside of buildings—ventilation, cleansing and disinfection, and measures of house drainage. The common view of the pythogenic nature of the disease must be modified. Pythogenic theory. Conditions most favourable to the spread of the disease.

There are facts which ought to be recorded in regard to the effect of segregation on a large scale in this Island. Notwithstanding that segregation was as well carried out as it could be from the 11th of March to the 31st of May, 1,073 cases occurred in the northern suburbs—a number in proportion to population greater than in the densely populated city during the epidemic period. In April the mortality was higher amongst the Mussulman population than in the worst period of the epidemic in the localities occupied by Mussulman, although they had not fled the city. On the spread of the disease. Effects of measures to secure segregation of the sick disappointing.

626. We have seen that the scavengers and halalkhores, although working with naked feet and hands in the filth from houses where cases had occurred, were the least affected of all classes of the poor, and we have seen that preparation made to resist the advance of the disease—the cleansing of the streets and the flushing of the drains of districts—had only the slightest effect on it. Little effect of anything done outside buildings in staying the disease.

627. We have seen in our experience that anything done outside the buildings in which cases have occurred has had little effect on the growth of the disease.

628. There is a varying and uncertain period between the time of the occurrence of the first observed cases and the subsequent prevalence of the disease or the epidemic period. A direct connection cannot always be established. In some instances they occur—the first and subsequent cases close to each other, in others they do not. It occurs at once to a student to inquire how the microbe which, as we know, is very easily killed or rendered inert in the laboratory, survives in the interval, and where it continues to live. The explanation that suggests itself to me is, that either the first cases observed were not the first cases that occurred, or that they were the first cases that had attracted attention (just a patient often ascribes his illness to the last chill, the last event that preceded the approach of sickness and impressed itself on his recollection), or that the microbe has more vitality in favourable conditions than experiments in the laboratory indicate. It may occur to an inquirer to ask if the organism passes through an intermediate stage in animals or elsewhere. The question can only be asked, for as one of the most distinguished members of the missions who came here to study the disease observed to me, this is still a "mystery" and can only be penetrated after prolonged inquiry and experiment. Period of incubation.

Places close to Bombay little affected till a late date.

629. It is a very remarkable circumstance that in a city so close to Bombay and other affected places as Kalyan, which is within 33 miles, only 78 cases of bubonic plague occurred up to July. Of the 78 cases, 49 were imported. The first case occurred on the 6th of October, and the last case on the 30th June. My information is dated the 22nd of July.

Vitality of the disease.

630. Although the bacillus of bubonic plague is so easily destroyed in a laboratory, it must have extraordinary vitality under the natural conditions in which it thrives. We see that the disease disappears from portions of the globe for long historical periods and then re-appears. There are only two explanations that can be offered of the course followed by the Pestilence through the ages: (1) either that the disease advances from an endemic area or breeding ground like an invasion of locusts; (2) or that it exists on many parts of the earth's surface in some modified form amongst human beings and animals. Both conjectures may be correct. We can imagine it existing amongst human beings in an endemic area and at the same time existing in other portions of the world in an attenuated form of disease amongst animals. The prevalence of tonsillitis and at times diarrhoea in the epidemic period suggested to me the existence and occurrence during the epidemic of a modified form of the disease.

Like an invasion of locusts. Does the disease exist in a modified form or type.

Prevention and importation.

631. The question of prevention arises. Can the importation of this disease into a seaport town in India or any other country, where malarial fevers are not uncommon, be prevented?

The spread of the disease difficult to arrest.

It cannot under certain contingencies. My opinion is, that it is not practicable by any measures in any part of India to prevent its spread, except when the type of disease is the simple glandular form and when the disease has not been communicated to rats. The opinions held in the beginning as to the ease with which the spread of the disease can be prevented are erroneous. The more knowledge we have, the more difficult it appears to be to recognise some forms of Bubonic Plague and to prevent the importation of the disease and its spread into a seaport town. Its introduction can only be detected when the disease is imported by human beings suffering from an easily recognizable type of the malady.

Prevention of the importation or conveyance of the disease very improbable.

632. When the disease is carried by rats or conveyed in clothing or other articles, its importation or conveyance is not likely to be prevented. The importation of cases into London in 1896 indicates how far the disease may be conveyed by sea, although generally it does not appear that the disease is conveyed long distances by a sea route. It appears to me that Bombay is in more danger from Upper India and the Kathiawar Coast and the endemic area by the Persian Gulf, than from China.

Measure to prevent or arrest the importation of the disease.

The measures that can be taken to prevent the importation of the disease may now be considered. There is only one measure from which any effect can be expected, and that measure is quarantine, or any other name by which inspection of traffic and restriction on communication may be called—stringent and careful examination of every one entering Bombay and disinfection of every article, but the result to be expected from that measure is very uncertain.

633. This conclusion, that quarantine, however ineffective, is the measure Quarantine. from which most effect is to be expected, must be admitted with the knowledge we now have of the disease. M. Haffkine was undoubtedly right in the advice he gave as to the measure that ought, on principle, to be adopted for treating the disease, though he did not hope for success from any measure; but he laid down the right principle, namely surrounding and preventing all intercourse with the infected area. When the disease is carried by other agencies than human beings, there can be little hope of interrupting its spread. The steady advance of this pest over Little hope of interrupting its spread under certain conditions. Continents suggests to some minds the reflection that either the disease may advance with the migration of rodents or that the microbe may have an existence in nature outside human beings.

When the disease has entered a large city, it is at once the most difficult and The most difficult and the most easy of diseases to treat. the most easy of diseases to treat. In crowded, dark, damp dwellings it is impossible to prevent the spread of the disease except by removing all the people, healthy or sick, from the buildings, or by treating the buildings as if they were on fire, and pouring into them streams of disinfecting fluids. The advice given by Dr. Cleghorn, when deputed here by the Government of India, to remove the healthy from buildings where cases occurred is undoubtedly sound.

634. The experience gained in this city suggests to my mind that measures Measures may be modified. either of disinfection or segregation may be modified according to—

- (a) The type of the disease.
- (b) The ventilation of buildings.

In the simple glandular form of the disease it is not necessary to remove the patient from a well ventilated building. Even in the Pneumonic form a discretion may be used in well ventilated buildings, occupied by few people. In dealing with this disease in a city the great danger to be avoided is the concealment of cases. The idea that the concealment of cases in a city can be prevented, is, I am afraid, a delusion of inexperience. Measures however excellent in a place where cases cannot be easily concealed may, in a large city, lead to the concealment of cases and assist the spread of the disease they are intended to check. The right measures must be enforced in the right manner.

635. It is not absolutely necessary to disinfect, although disinfection is to be Not necessary to remove every patient to an Hospital. A discretion may be exercised. recommended, a building from which the roof has been taken off and every portion of the floor exposed to the sun; nor is it necessary to remove everyone suffering from the disease from a well ventilated building to an hospital. A discretion can safely and wisely be exercised.

636. To the future of Bombay the prevention of the importation of fresh The future. cases is of the highest importance. I therefore urged on the Plague Committee that so long as a case occurs in any place in direct communication with Bombay, My advice to the Plague Committee. I protested against relaxation of precautions. not one measure to check the propagation of the disease can be relaxed with safety. If the interests of the city are not to be neglected, if the interests of all in communication with Bombay are not to be disregarded, not one measure, I maintain, ought to be abandoned nor one precaution relaxed. I contend that the measures depend not on the number of cases, but on a case either within or without Bombay.



637. The question may be asked, why the removal of the sick to hospital after the formation of the Plague Committee was not resisted, and why it proceeded so easily.

638. To anyone acquainted with this city at the time the explanation of the easy progress in the operations for the removal of the sick is as evident as it is natural.

The reason why the operations of the Plague Committee proceeded easily the epidemic was over.

639. The virulence of the epidemic had been declining since the end of January, the mortality had been decreasing week after week, and the people believed that the epidemic was over and had passed away beyond Bombay.

640. The masses of the people were as certain in March that the epidemic had passed away as they had been in February, when all real cause for panic had passed away, that the epidemic was only commencing and that the disease would kill most of the people and ruin the city.

641. Many of the people thought and think still, as people in other countries besides India believe, that disease comes and goes as an evil guest, and that it is to be sped on its way.

642. Believing that the epidemic as an evil influence had departed, the dread of the pest had passed off and the people had become cheerful.

Bombay saved.

643. At last they knew that Bombay had been saved.

644. Many looked on the inspection of buildings as an amusement in which they took a part as spectators.

Few cases.

645. The disease had spread beyond the most crowded localities to the suburbs, the sick in each locality were few, and the removal of a few people from places at some distance apart scarcely agitated the population, when each one confidently hoped to escape the contagion.

646. As in the beginning, the mortality had been exaggerated in the popular imagination, so now the loss of life from the pestilence was lightly estimated.

In 1896 far different.

647. It was far different in 1896; then the disease was concentrated in the most crowded houses of the most densely populated portions of the city, and in each street there was mourning and grief. The cases were close together, and, being close together, they appeared more numerous than they were. The people were as gloomy in October as they had been cheerful in the beginning of April.

648. There was also a feeling that the measures of the Plague Committee were intended not to assure Bombay against plague, but against other disasters even more apprehended at that stage than pestilence.

Operations of the Plague Committee when commenced.

649. It was fortunate that the operations of the Plague Committee were not commenced before the end of March, when the people were returning to the City full of life and cheerfulness.

650. There was a desire to help and a cheerful feeling amongst the people People cheerful. now full of hope for the future of the city; and the populace, having recovered from apprehensions of the epidemic, had a wish to restore Bombay to health and prosperity, and to regain the confidence of the world.

651. There was also another powerful influence animating the people. They had seen the epidemic spread to the cleanest parts of the Island, and in some of these favoured localities, destroy more people than in the most densely populated parts of the city. They had seen the disease carried beyond Bombay, and they were now assured in their minds that the epidemic had not been caused by insanitary conditions within the Island, conditions that would always surround them, and from which they could not with the city hope to escape. The epidemic had come as a storm-wave and was passing away.

652. It was not the guard of soldiers that prevented disturbances.

The description that DeFœe gives of the joy of the people of London, as London and Bombay. they were delivered from the pestilence, may be recalled, as there is much in it that pictures the feelings of the people in this city as the disease passed away and the city recovered in health and prosperity.

“ But it was all to no purpose ; the audacious creatures were so possessed with the first joy, and so surprised with the satisfaction of seeing a vast decrease in the weekly bills that they were impenetrable by any new terrors, and would not be persuaded, but that the bitterness of death was passed ; and it was to no more purpose to talk to them than to an East wind ; but they opened shops, went about streets, did business, and conversed with anybody that came in their way to converse with, whether with business or without ; neither inquiring of their health, or so much as being apprehensive of any danger from them, though they knew them not to be sound.”

653. The success of the direct operations of the Plague Committee in the inspection of buildings, and the removal of the sick, was entirely due to the large staff of medical men and Sub-Inspectors already trained and accustomed to the same duty in the Health Department, and to do battle with the disease. Success of measures of the Plague Committee due to the large staff of Medical men and Sub-Inspectors trained in the Health Department and already on duty and battling with the disease.

654. Had I not trained and had ready in the Health Department a number of medical men and Sub-Inspectors, soldiers must, as in Poona, have been employed for the inspection and disinfection of houses. The large number of troops employed by the Plague Committee to assist in the work of inspection long after the crisis had passed (for the Plague Committee really began outdoor work after the 17th March, when house-to-house inspection was organized with the support of troops) was a proof of the difficulty of carrying out segregation by the Municipality, unsupported by troops, before and during the crisis.

655. I differed totally from the policy of reducing the establishment Reduction of establishment. I differed from the Policy of the Plague Committee. pursued by the Plague Committee after May. I think the policy was wrong, and I protested against it. My views are shown in the following extracts from letters. I wrote on this subject on the 19th of May 1897 :—

“ There is a most grave responsibility, remembering the impossibility of obtaining a sufficient staff when the epidemic commenced, in reducing any establishment.”

“The loss to the commerce of the City caused through the epidemic cannot be forgotten—a loss estimated at one time as amounting to 12 lakhs a day. There is also another view, that men who have most gallantly and unselfishly risked their lives ought not to be discarded and their services forgotten, as though they had not rendered invaluable services in the time that has so recently passed. It is most demoralising, such treatment to a public service, for no man can be expected to risk his life if the moment the emergency has passed he knows that he will be cast aside and all that he has done forgotten. At any rate, the fullest publicity ought to be given to the fact if a reduction of establishment is effected, so that all in communication with this City may know what is being done and may be able to form an opinion as to how far commerce can safely take place with Bombay, while the areas around and in communication in Bombay are infected, and while measures in Bombay are being relaxed.”

656. On the 15th of June 1897, I wrote :—

I protest.

“It appears to me there will be a very serious responsibility in the closing of hospitals and the dispersion of an experienced staff, which was collected with very great difficulty after some months, should there be a recrudescence of the disease. I assume that the action of the Plague Committee is the result of responsible medical advice, and I venture to think that this advice should be submitted to us.

“The position is this, and I can see no way to explain it away—if the staff is not necessary now, it was not necessary two months ago. There are cases now. If a case was considered a danger two months ago, it is equally a danger now.

If the measures of the Plague Committee were necessary in the beginning they were necessary up to the end.

“As far back as the middle of January 1897, I wrote a note which was printed in the *Government Gazette*, that the epidemic had reached its maximum and would progressively decline. This decline has occurred. I accepted the policy that each individual case was a danger, and to carry out that policy a large establishment was employed. There are now cases, and each case is as much a danger now as it was then.

“If an establishment was necessary two months ago, I think it will be held by all responsible authority that it is necessary now. If it is not necessary now, it was not necessary two months ago. No authority will admit that the number of cases makes any difference in the measures to be taken and the organisation to be kept in readiness.”

The work of the Health Department the only business not interrupted.

657. The work of the Health Department was almost the only business in the City not interrupted during the weeks of panic. The duties were performed with the regularity of an ordinary year and in promptitude of work with even more than the usual readiness.

658. I have in a previous portion of the report referred to this gratifying statement. Few men deserted. At times, as I have already written, there was a movement amongst the scavengers and hallalkhores to leave, but fortunately for the City, the movement was frustrated by the measures adopted. Let it, however, be placed on record that few men or women in the Department deserted.

659. I append a list showing the names of the Assistant Surgeons and Hospital Assistants whose services were lent to the Municipality by Government.

660. The Assistant Surgeons were placed in charge of districts, some of them being very large, and the Hospital Assistants were utilized for duty in the City and at the hospitals and cemeteries and for general duty in the supervision of sanitary measures.

661. These officers have all given most willing help, and I regret that Government found it necessary, owing to the demands on the medical service in connection with plague, famine and military duty, to recall a number.

662. The training and experience they gained here suggested to Government the utilisation of the services of several of the Assistant Surgeons as special Plague Officers in charge of towns or districts in various places outside Bombay, and I venture to bring the names of all the Assistant Surgeons and Hospital Assistants to your favorable notice.

ASSISTANT SURGEONS.				REMARKS.
1.	Dr. R. J. Kapadia	...	...	} <b>Withdrawn by Government.</b>
2.	„ N. D. Merchant	...	...	
3.	„ S. M. Mehta	...	...	
4.	„ R. J. Pettigara	...	...	
5.	„ D. Ross	...	...	
6.	„ R. W. Pettigrew	...	...	
7.	„ C. H. Twells	...	...	<b>Withdrawn by Government.</b>
HOSPITAL ASSISTANTS.				
1.	Hari Narayan Mahajan	...	...	<b>Withdrawn by Government.</b>
2.	Bhikabhai Haribhai	...	...	
3.	Parbhuram Tuljaram	...	...	
4.	Rajaram Shivram	...	...	
5.	Coovarji Rustamji Avari	...	...	} <b>Withdrawn by Government.</b>
6.	Keshavlal Motilal	...	...	
7.	Pandharinath Bhawanrao	...	...	} Work at the Arthur Road Hospital.
8.	Chunilal Chhotalal	...	...	
9.	Chaturbhai Govindbhai	...	...	
10.	V. Appadorai Nayagar	...	...	<b>Withdrawn by Government.</b>
11.	Punjabhai Thakersy	...	...	
12.	Khan Bahadur Yousif David	...	...	
13.	Khan Saheb Shaik Kadir	...	...	(Works under Plague Committee)
14.	Shaik Rajakhan	...	...	} <b>Withdrawn by Government.</b>
15.	Gopinath Yeslwant	...	...	
16.	Manicklal Manoredas	...	...	

663. Dr. Dallas and Dr. Ranina can never forget the early days we spent together in Mandvi. In the office of Dr. Dallas a small dispensary was opened. We often met at night on the Masjid Bridge, and walking through the streets, deserted by all but mourners, entered the houses, in front of which fires were burning, to inquire whether any more had been stricken. The Deputy Health Officers and the Special Medical Officers deserve well of the City; they performed their duties admirably, whether in the treatment of buildings or in the removal of the sick. The performance of their duties required judgment and often courage. They were nearly as much abused or molested as the Inspectors and Sub-Inspectors, when they commenced to take a part in the removal of the sick and the treatment of buildings. I beg leave to bring to your favorable notice the services rendered by the Medical Officers. Two of the Deputy Health Officers, Dr. Sorab Cavasji Hormusji and Dr. K. B. Shroff, had already acquired practical experience in sanitation in other cities in India. On the 1st of March the following Medical Officers were on duty :—

Great services  
rendered by the  
Medical Officers.

Sorab Cavasji Hormusji.	D. Ross.
K. A. Dodihalkar.	R. W. Pettigrew.
K. B. Shroff.	C. H. Twells.
L. G. Godinho.	Bhikabhai Haribhai.
Alexander Britto.	Pandharinath Bhawanras.
M. H. Bhatavdekar.	Purbhuram Tuljaram.
R. N. Ranina.	Rajaram Shivram.
H. C. Malegaumwalla.	Keshavlal Motilal.
A. McCabe Dallas.	Chaturbhai Govindlal.
Dosabhoy R. Bardi.	Hari Narayan Mahajan.
K. M. Gimi.	Chunilal Chotalal.
S. B. Jathar.	Punjabhai Thakersy.
M. N. Kapadia.	Khan Bahadur Yousif David.
A. P. Dantes.	Khan Saheb Shaik Kadir.
R. J. Kapadia.	Rajah Khan.
V. D. Merchant.	Gopinath Yeshwant.
S. M. Mehta.	

664. The Inspectors and Sub-Inspectors of the Health Department behaved magnificently. I believe I am only expressing the general opinion when I write so. They had duties at all times of an unpleasant, and sometimes even of a loathsome nature, and often of great danger to perform, but they never shirked them. They had often to carry the sick or lift the dead, but they never hesitated to do it. The Senior Inspector, Mr. Glover, nobly doing his duty, died in January from bubonic plague. Two others of the Inspectors suffered from the disease and five Sub-Inspectors were affected, of whom two died.

665. I have already recorded the phenomena that preceded or accompanied the appearance of the epidemic and the events that followed, and described the course of the pestilence as exhibited in the statistics of the mortality. I now propose to briefly describe the events after the beginning of March, and to review the

measures adopted for the treatment of the disease during the operations of the Plague Committee. I was appointed Chief Medical Officer on the 8th of March, a day or two before having assumed duty in the office of the Plague Committee. It had been decided to obtain, as soon as possible, a number of medical officers from Government and place them in charge of districts, but it was not possible to obtain all the Medical Officers required from Government. The base of operations having been transferred to a district hospital from the ward offices of the Health Department, it was necessary to arrange the boundaries of the districts to correspond with the areas of hospital supervision. The boundaries of the districts did not, therefore, always correspond with the areas of the Health Department wards. This caused inconvenience in sanitary work, as I will explain. In some districts there were portions of different wards and more than one inspector to assist the Medical Officer, while at the same time an inspector in these districts had to serve more than one District Medical Officer. There was a practical disadvantage in this arrangement, for the inspector who had to be summoned to assist in all serious work, having to serve more than one medical officer, might, when engaged with one medical officer, be required in another district by another medical officer. Yet, with tact and patience, the inconvenience was made as little of as possible although the inspectors were often called away from conservancy duty to assist in plague operations. In all the operations undertaken—the Inspectors and Sub-Inspectors of the Health Department had to do the most serious and the heaviest work. This was necessarily so.

666. Surgeon-Captain Dove took over charge of No. 1 District on the 23rd of March 1897. In this district an hospital had been opened on the 10th of March at Pilot Bunder in Upper Colaba, and 12 cases had been treated. Dr. Dove organized a system of house-to-house visitation in Colaba in co-operation with the Justices of the Peace. I regret that after one inspection he was transferred. Surgeon-Major Culling assumed charge of the district, which he continued to hold up to the 16th of April, on which date he was invalided to England, and the district was placed under Surgeon-Lieutenant Howell. District No. 1.

667. The inspection of dwellings in this district, in conjunction with Justices of the Peace, proceeded regularly, and there was no interruption in it. The buildings were systematically and thoroughly inspected.

668. From the 11th of March to the 31st of May, 78 cases occurred in this district.

669. District No. 2 was placed in charge of Surgeon-Major Damania from the 10th of March 1897. I commenced at once to organize with Surgeon-Major Damania a system of inspection of buildings to be followed by the Justices of the Peace. The buildings were grouped in blocks, and one or more blocks given to each Justice of the Peace. The inspection of buildings proceeded regularly. Surgeon-Major Damania was transferred on the 5th of April, and Surgeon-Major Routh took over charge of the district. District No. 2.

670. The hospital for this district was opened on Mody Bay, in a position I had selected for a Municipal Hospital. It was opened on the 31st of March.

671. Surgeon-Major Routh was transferred on the 20th of May 1897, having done excellent work in the district, and Surgeon-Lieutenant Howell succeeded him. Dr. Howell was therefore placed in charge of No. 1 & No. 2 Districts, which were now grouped together.

672. The inspection of buildings in this district proceeded steadily, although it is not surrounded in this portion of the City with so many difficulties as have to be overcome in crowded localities occupied by the turbulent classes in other portions of the island.

673. For sanitary work in this district, tact and a knowledge of the classes who live in it are required, and in order to secure the enforcement of measures the support of the classes most likely to be useful has to be sought. Dr. Howell has conducted the duties with tact and judgment.

674. From the 16th of March to the 31st of May, 67 cases occurred in this district.

District No. 3.

675. District No. 3 embraces the Health Department Sections of Mandvi, Chuckla, Dongri and Umarkhadi forming "B" ward, representing a population of 152,277, grouped in densely populated dwellings.

676. The density of population in this district will not be fully understood from the following table showing the number of square yards to each person in each section, for in Mandvi and Dongri Sections are included the open ground on the foreshore and the quarries of Dongri. In portions of these sections, the density of population is appalling, the houses are so close together that the sun's rays cannot at all hours enter the narrow lanes, and there is sunshine only at midday for a short time.

Section.	Mean area for each person in square yards.
Mandvi ... ..	18.81
Chuckla ... ..	6.74
Dongri ... ..	41.50
Umarkhadi ... ..	9.33

677. The sections of this district require the closest attention; one of them, Mandvi, being the section in which bubonic plague was first observed. To this section there was a rapid tide of immigration from Kathiawar and Guzerat, and during April last a great probability also of a recrudescence of bubonic plague in it.

678. Dr. Bernard, R. N., was first placed in charge, but, being recalled for service elsewhere, the district was placed in charge of Surgeon-Captain Brogden. Previous to the appointment of the Plague Committee, excellent work had been done by Surgeon-Captain Jennings, who was in charge of the district. A number

of houses had been condemned or improved, and water-pipes removed from positions in which they caused dampness.

The measures in this district which are urgently needed are :—

1. The condemnation of buildings unfit for human occupation.
2. The opening of cross streets and lanes.
3. The improvement of privies.
4. The removal of water-pipes from positions in which they may cause dampness inside dwellings.

Sanitary State of  
Mandvi.

679. In regard to the sanitary state now of the Section of Mandvi, where bubonic plague was first recognized, it has not yet been greatly altered, as the district is one of large, closely built and densely populated houses. The value of property in this portion of the City is very high, and improvements, even widening of the streets, are most costly. Improvements have been made and are being effected, but they can only be effected very slowly.

680. The chief improvement effected at the time of the prevalence of bubonic plague was in the treatment of the house drainage, the removal and cleansing of the downtake pipes, and the construction of open drains and catchpits between buildings and the sewers where cases occurred.

681. It is very desirable that the privies inside many of the buildings which are often in insanitary positions should be rebuilt. There is further the very important question of the storage of articles of food underneath dwellings; granaries or godowns should not, I think, be permitted underneath dwelling rooms. These recommendations are, however, most difficult to give practical effect to. The improvement of privies in private buildings can only be imperfectly and slowly effected after long prosecutions, and it is needless to say that the number of prosecutions can only bear a small proportion to the number of buildings to be improved.

682. When in the beginning of the epidemic cases occurred in portions of buildings over or near godowns, the godowns were closed for 20 days, or until a period of 20 days had elapsed after the occurrence of the last case, and in the meantime disinfected or flushed out with fluids and afterwards disinfected with sulphur fumes and finally lime-washed.

683. Many of the godowns are damp or dark from insufficient light, and, when closed, have no means of ventilation. During the hot season the godowns of Mandvi were systematically lime-washed and disinfected.

684. In my opinion, for the improvement of this district, nothing less than the opening of cross streets or lanes, which should run west and east, and north and south, and the demolition of blocks of buildings so as to leave open spaces is necessary. I would also recommend the opening of footways in the most densely populated parts of Mandvi. In portions of Mandvi there are narrow and crooked



alleys or passages between high and densely populated houses. The widening of these alleys would effect a great improvement and facilitate traffic.

685. A little progress has been made since last September in the construction of house connections with sewers in this district; as cases occurred, improvements to the house drainage were carried out by the Municipality, but the improvements, although most beneficial, were confined to the construction of open gullies and catchpits. There are sewers in this district that have been ready for use for many years, to which connections with all the buildings have not yet been made. I believe that notices have been served by the Municipality and connections I see are now being made in some streets.

686. I organized house-to-house inspections on a large scale in this district and the Plague Committee were present at most of the inspections. The largest number of sick found during any one of the inspections was 17 in one day in Dongri Section. This section, representing a population of 30,317, was surrounded by a cordon in the early morning, and each house inspected. I formed four large parties for the inspection, each party made up of

Medical men	} Health Department.
Inspectors	
Sub-Inspectors	

Inspection of a  
Section.

687. The Plague Committee were present and took part in the inspection. It was most successful, and the people displayed a kindly feeling and often gave assistance. I always endeavoured to impress on people that the duty, however unpleasant, was a necessary one, and I think we tried to give to the inspection the appearance of gravity that a serious duty deserved.

688. From the 18th of March to the 31st of May, 462 cases occurred in this district.

District No. 4.

689. District No. 4 was organized out of four sections of the Health Department, "C" Ward. It represents a population of 142,558 and contains portions of the most densely crowded and insanitary localities in Bombay. There are two sections in this district—Khara Talao and Kumbharwada—which had, by the last census, a population of 59,244 and only 7.02 and 6.37 square yards to each person respectively. The other two sections of the district—Market and Bhuleshwar—contain blocks of most insanitary buildings and localities of dense surface and house crowding.

690. The district was placed under an officer of great experience, Surgeon-Lieutenant-Colonel Hamilton, and house-to-house inspection, although the district contains a population who were most opposed to segregation, proceeded without any disturbance and indeed, with few unpleasant incidents. The Committee were present at the most important inspections in this district.

691. While cases of bubonic plague and the treatment of the buildings in which they occurred received the closest attention, the improvement of the general sanitary state of buildings was given much attention to. Dr. Hamilton gave great

attention to the disinfection of buildings. An improvement that could steadily be effected was the cutting off of the water-supply inside buildings, and the removal of water-pipes from positions, such as the inside of rooms where the splashing of water caused dampness. In portions of Khara Talao and Kumbharwada, a very important sanitary improvement on a large scale was effected by cutting off the water-supply inside buildings where waste of water and the dampness through it was a danger to the health of the residents. In these sections and other districts, as in Kamathipura, water connections inside buildings were a source of the greatest danger and until they were cut off, and the supply of water to pipes inside the buildings and rooms stopped, we felt that our measures were not complete to protect the buildings.

692. Dr. Hamilton was of opinion that the improvement of many of the localities in this district could only be effected after demolishing groups of buildings, and that it was scarcely practicable to effect much improvement in many of the darkest and dampest buildings without demolishing portions of them.

693. From the 18th of March up to the 31st of May, 290 cases occurred in this district.

694. In District No. 4, at one inspection, a pitiful incident occurred. We looked into a room and saw a number of women sitting round a dish and eating, one of whom, somehow, attracted our attention. Strange to say, she was found to be suffering from plague, and during removal to hospital almost collapsed. This is an instance of the extraordinary strength that a desire to escape hospital treatment gave dying people.

695. District No. 5 comprises Dhobi Talao, Fanaswadi, Girgaum and District No. 5. Chowpati. Surgeon-Lieutenant-Colonel Wilkins assumed charge of the district on the 11th of March. This district had been divided into groups of buildings, for it is possible to do this more easily in most of the sections than in the congested localities of Districts Nos. 3 and 4. Dr. Wilkins opened and organised an hospital in the Charni Road Gardens, and he had general charge of the private hospital in the Adamji Peerbhoy Sanitarium. Excellent work was done by Dr. Wilkins in house-to-house inspection assisted by the Justices of the Peace, although the epidemic in these districts had long commenced to decline.

696. The most insanitary portion of this district is in Dhobi Talao, where there are numbers of buildings not very large, but very close together and much over-crowded. It is impossible to improve these localities without demolishing some of the buildings. The centre buildings of the worst groups of houses should be demolished and roads or lanes leading out from such open spaces constructed. A small beginning has been made in one portion of Dhobi Talao. In improving localities, the object is to let light and air into them and this, can only be effected by demolishing buildings.

697. From the 21st of March to the 31st of May, 117 cases occurred in this district.

698. District No. 6 comprises three sections of high mortality—Kamathi-District No. 6. pura and 1st and 2nd Nagpadas. In these sections, owing to the large number of poor and outcaste collected in them, the imperfections in the drainage of the two

Nagpadas, and the serious nuisances caused by the throwing of refuse out of buildings or from windows either on to the roads in front (into some of the streets in Kamathipura cart-loads of *bidi* leaves are thrown daily) or on to the gullies, and, owing to the density of the house population and the large proportion of out-caste and vagrant population, the sanitation requires the most careful supervision. In all three sections the greatest passive opposition was met with ; for instance, I can remember only a few instances in one of the sections in which information was given to us of cases of bubonic plague.

699. In the Nagpadas we met with opposition and hostility, and our parties were frequently resisted, but individuals assisted us in the cleansing of buildings.

700. The Nagpadas have been for many years the subject of long complaint from me. There is dense house-crowding in buildings constructed by the sides of shallow water-ways, now covered, which are the channels and means of drainage. In many of the streets the surface of the ground has to be broken every day to remove obstructions in the drains—mere tracks under ground, shallow water-ways as I have described them, down which sewage trickles. There is also an abominable sewer underneath a number of dwellings. Many of the buildings had water-pipes in dark rooms, these pipes have been cut, and the water-supply stopped. Since last December, the cutting off of water-pipes has been given much attention. I cannot give a better idea of the Nagpadas than by the following extract from the Annual Report of 1894-95, page 524 :—

“The drains are getting worse, and our efforts to clean them only make them worse ; where there are trenches unmade, or ditches for rain into which drainage flows, each cleaning, each sweeping, makes them deeper, and the construction of new drains or even the repair of old drains has been put off until a general drainage scheme has been sanctioned.”

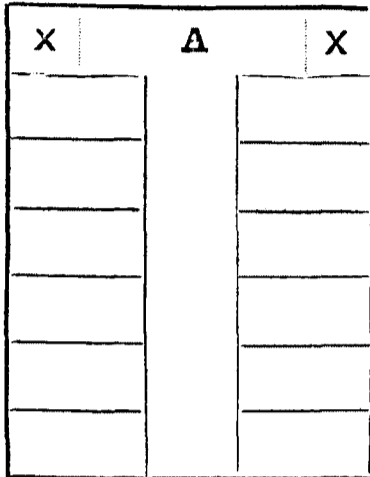
In the last Annual Report I wrote :—

“In 2nd Nagpada we have the greatest house-crowding—as many as 67-18 persons collected, 15 families to each house, in each crowded dwelling. We have a mortality from Phthisis, more than double that in Byculla, nearly twice the mortality in Parel, and more than twice the average mortality in all the other sections of the City ; and a death-rate from diseases of the Respiratory System of twice the mortality in the whole city. In 2nd Nagpada the pressure of population is greater than in the most crowded and dense section of London. The extreme in London is 222 persons to an acre, whereas in 2nd Nagpada it rises to 469 !”

701. I am glad to report that the system of drainage is being completed in the Nagpadas. The completion of the drainage will effect a great improvement.

702. In December of the last year, I had to recommend the adoption of the extreme measure of cutting off the water-supply from all buildings in Kamathipura and from a few of the worst dwellings in the Nagpadas, owing to the dampness caused through the waste of water.

703. At the back of each building, consisting of a single or double row of <sup>Buildings in Kama-</sup> ~~thipura.~~



rooms, frequently the central rooms in complete darkness, is a water-pipe, in a little space at one end, on one side of this little space is the privy, on the other side the water-pipe. In this little space **A** (**A** as in sketch) at the back of the last rooms, where the water-pipe was generally dripping, the clothes of all the people are washed, and in the washing the walls and floors of the nearest rooms are splashed. It is impossible to imagine conditions of dwellings more favourable to the development of zymotic diseases, and it must be remembered that in this locality more than 15 per cent. of the most disreputable and unwholesome of the people of Bombay live,

and further generally sleep on the ground-floor.

704. The level of the subsoil in this district and the adjoining locality is the highest in Bombay, and polluted through old reclamation with refuse. A few feet under the surface in places may be found undecomposed refuse. This pollution of the soil has often been referred to and described in the Municipal Reports.

705. Assistant Surgeon Pettigrew conducted the duties of the district from the 14th of March to the 17th of May, when he handed over charge to Surgeon-Major Deane. His duties in this difficult district were not always easy of performance, but he discharged them very well. At the large inspection parties I organised, his assistance was of much service to me.

From the 23rd of March to the 31st of May, 263 cases were removed from this district. During an inspection in Nagpada, a curious incident occurred on the ground-floor of a dwelling occupied by Dhobies. The room was filled with clothes, and, on examining them, we saw protruding from underneath one bundle of clothes, a pair of elbows, and pulling the bundle off, we found a Dhobi underneath, almost dazed and suffering from plague. All the clothes were disinfected, and the dhobi taken to hospital. In the same district, we detected a Seedee or negro-boy, suffering from plague. His mother most fiercely resisted his removal, and, in order to pacify her, we had to send for the King of the Seedees, who, on his arrival, had the boy removed to hospital.

706. The following incident shows how strong the desire to escape was. Just after daylight, when I had posted sepoy round the whole of Nagpada an officer of police stopped a bullock cart and saw inside an Arab woman. I was asked to see her, and, as she did not object, I examined her. She was suffering from plague, and I sent her to hospital. She did not object either to go to hospital. Strange to say, after being in hospital a few days she suddenly ran out, out of the building, she was followed, brought back, and died almost immediately afterwards.

707. On this same morning just afterwards, a beggar wandering round the streets, was stopped, and found to be suffering from plague.

District No. 7.

708. District No. 7 was formed out of the Health Department sections of Mahalakshmi and Walkeshwar. Although the population is only 30,004, the area of the sections amounts to 911.01 acres. At the period when the district was formed, a number of cases were occurring in both sections of it, the disease having passed across the Island to Chowpati and Tardeo, and on to Walkeshwar and Mahalakshmi. The cases chiefly occurred amongst the classes in domestic service, and the prompt removal of them to hospital, long before the appointment of the Plague Committee, was a duty of great importance. I believe that this duty was admirably performed, and there were not any complaints of neglect or delay in the performance of it. In the treatment of buildings where cases occurred, very drastic measures were adopted; huts were burnt down, and the roofs of the other classes of dwellings, occupied by servants removed, and the buildings were flushed inside and outside with disinfectants and lime-washed. The servants were removed from the rooms in which cases occurred. The success of the measures adopted was much greater than might have been expected, considering the very exacting criticism to which work in this district was subjected. At the present time the disease has been stamped out of this district. The last case in Walkeshwar occurred on the 28th of August, and the last case in Mahalakshmi on the 29th of May. From the 18th of March up to the 31st of May, notwithstanding all efforts of segregation as many as 155 cases occurred in this district.

District No. 8.

709. District No. 8 comprises the large area of Byculla section, and the sections of Tardeo and Khetwady, it is bounded on the north by Clerk Road, on the south by Girgaum Back Road, on the east by Parel Road, and on the west by the B. B. & C. I. Railway, and has an area of 1,138 acres and a population of 95,197. This district, owing to its large area and the large proportion of the artisan and poorer classes and the outcast population collected in the dampest and worst drained portions of it in densely populated chawls or huts situated in imperfectly drained localities, requires most vigilant supervision. Large areas of Byculla are without drains; and buildings in other portions, where there are drains, are on such low ground that they cannot be drained. The sanitary supervision of the district was therefore a task of great difficulty. In the rains large portions of Byculla are flooded with sewage and water, and all ground below the level of the public roads is under water; after rain swirling currents of sewage and water rush through the district to the low-lying levels.

710. In portions of Khetwadi section, inhabited by the poorer classes of Mussalman and Hindus—in the turbulent areas intersected by Falkland Road, we have at all times met with the greatest opposition to the application of sanitary measures and segregation. The inspection of buildings in search of concealed cases of bubonic plague proceeded regularly, and I organized search-parties on a large scale. It was in the beginning only possible after a demonstration of force to search dwellings in some few portions of this district occupied by disorderly classes and to remove cases of the disease. It was not necessary to use force, but force was ready. The people were persuaded to consent to the examination of their rooms and to the removal of any cases, but there were fortunately few cases to remove.

711. Two hospitals in this district were opened, both were for the poorer classes of Mussalman. A large number of these were of the Joolai or weaver class, who are very excitable sometimes, and often turbulent. From the 30th of March 1897, 187 cases occurred in this district, and there was at times a small recrudescence in the Byculla section. This portion of the district must be most carefully watched after the rains, as a large area—more than one half—has buildings, after heavy rains, standing in sewage and water. From all the poorer classes of buildings, tiles were taken off to let in light and air, and a great number of rooms in verandhas obstructing the entrance of light to the inside of the buildings broken down. In this district an immense amount of work in making openings in the walls of chawls, sheds, and huts, was done by the Health Department. This measure was effected with much difficulty, and we had the greatest trouble in getting men to do the work. A number of huts were demolished.

712. Dr. Deane took over charge on the 30th of March 1897, and whether in the treatment of plague or in the sanitary work of the district, he took the greatest interest and did admirable service at a difficult time.

713. Dr. Britto, who had been in charge of two large sections of an area District No. 9. called E Ward, East, assumed charge of two sections of this area, out of which was formed District No. 9. This district is a very scattered one, and, in portions populous; the population being concentrated in densely populated groups of dwellings in undrained localities. The absence of drains, or, where channels exist, their imperfect construction and condition renders the cleansing and disinfection of buildings very difficult. It was a difficult district to work, and the detection of cases in portions of the locality has been surrounded by many difficulties. Inspection work has been proceeding regularly with the Justices. The population being grouped in chawls or dwellings forming large villages gave facilities for inspection, the groups being cordoned by military or police, before house-to-house inspection was commenced.

714. Three (3) hospitals were opened and excellent work was afterwards done in them, while they were used as segregation camps for persons detained on arrival in Bombay from infected ports or stations.

*Hospitals opened.*

Name.	Date.
Wari Bunder ... ..	26th of March 1897.
Reay Road ... ..	1st of April 1897.
Narel Wady ... ..	25th of April 1897.

715. The treatment of buildings by disinfectants in portions of this district was very difficult owing to the imperfect state of the drainage. The drainage is either by open water-courses or by badly constructed open drains with roughly-paved sides, ending in cesspools. In one portion of this district, near Mazagon

Bunder, the population are collected in small buildings almost up against each other, around narrow passages wide enough to admit one person to pass. We had to use firepumps in disinfecting the buildings. A large number of rooms in verandahs were broken down, and an immense number of openings to admit air and light were made in walls by the Health Department, and tiles were taken off a great number of buildings. In some groups of buildings the roofs were taken off or lines of tiles removed. Dr. Britto rendered good service.

District No. 10.

716. District No. 10, although extending over the north of Island and the furthest away, was the first district in which work was commenced on the 17th of March. Dr. Jennings, who had been appointed Medical Officer, District No. 10, took over charge of his duties on the 11th of March.

717. On the evening of the 11th of March, General Gatacre met in Parel a number of the Justices of the Peace who had written to His Excellency the Governor and offered their services. They had now been summoned to Parel to receive instructions as to the nature of the duties to be undertaken. The procedure that would most likely have to be followed having been explained to the Justices and discussed with them, Surgeon-Captain Jennings was placed in charge of this large district, comprising the Municipal Wards, F and G, covering an area of nearly half the Island of Bombay, and representing a population of 98,402. The Health Department ward staff were placed under his orders, and a staff of 12 Justices, 3 Medical Officers, 1 Inspector, 16 Sub-Inspectors, 1 Muccadam, 16 Police Sepoys, and 60 Military Sepoys, given for the inspection of buildings, and 1 Inspector, 4 Sub-Inspectors, 4 Muccadums and 100 coolies, detailed for the special disinfection of all buildings in which cases of bubonic plague or suspicious cases of fever might occur.

718. I arranged on the morning of the 17th of March to have a rehearsal for the Justices of the Peace of this district. I met the following Justices at Bandra Causeway :—

Veterinary Major Mills; Drs. DeMonte, Oliviera; Messrs. K. M. Sbroff, J. C. Cama, Shaik Adam Peerbhoy and Vussonji Khimji; Inspector Hallums and Inspector Cunningham. After a consultation we proceeded to carry out the operations that we had discussed and sketched out before. We divided into two parties—one in charge of Dr. Jennings, attended by a proportionate staff of the Health Department, military and police, and a second party under myself, accompanied by the Justices and an Inspector, Mr. Hallums, of the Health Department, and a proportionate number of the military and police sepoy. The military and police were posted in positions commanding the approaches to each group of buildings. The inspection commenced with a group of buildings immediately to the south of the Mahim Fort, off Mahim Bazar Road. The result of the search was the discovery of two cases of plague and one doubtful case and the examination of a dead body. The incident in the morning's work that caused most surprise was the detection of a case in the compound of one of the Justices, who was himself engaged in the inspection. The sufferer was a Malce.

719. Since then the inspection of buildings in Mahim and other portions of F and G Wards, and especially in Dharavi, has been proceeding regularly, and

excellent work in which some of the Justices have co-operated, is being done. There was not one incident of a disagreeable kind during the operations that were, and are being, conducted for the eradication of the disease. Three hospitals in the district were opened.

720. A great deal of attention has been given to the organization of a system for the inspection of all people entering the City by the two northern highways and the pathways on the sides of the water-mains. Towards the end of March the system to be introduced for the inspection of people coming into Bombay over the causeways was fully considered, and, after careful enquiry, the arrangements necessary to be made were completed.

721. From the 11th of March to the 31st of May, as many as 1,073 cases occurred in this district notwithstanding that segregation was as well carried out as it could have been. Large number of cases notwithstanding segregations.

722. In May last the immigration of the destitute, enfeebled by want, numbers of whom had walked to Bombay, even from Central India, caused the greatest anxiety. Immigration of destitute.

723. Sir Charles Ollivant, K.C.I.E., after his arrival, inspected a number of people who had returned to Bombay from the Coast districts, and the famished or emaciated look of the people reminded him of the appearance of the people who came to this City, in large numbers, during a period of distress a good many years ago and suffered greatly from cholera and caused much anxiety in the city at that time.

724. The people, questioned by Sir Charles Ollivant, were not ill, but they were weak; they had fled some months before from Bombay to the Ratnagiri and adjoining districts, and had little to live on. They were not sick, but they were weak and they were in the most favorable state to contract disease. I wrote to the Commissioner in August last, apprehending the appearance of great numbers of famine-stricken people pouring into the City over the causeways by land and by the sea ways. I recommended that arrangements should be made for the establishment, as was done by me in 1877, of three large camps for the detention of famished people—one camp to be outside the Island at Coorla, one on the Flats, and one on Mody Bay. I wrote in May to the Plague Committee on the same matter to the effect that so far as outbreaks of cholera amongst the permanent population, the Health Department have never had any difficulty in dealing with the disease; but in regard to outbreaks of cholera and relapsing fever—as both diseases will be prevalent amongst famished people, and amongst destitute immigrants—a totally different treatment to that necessary in dealing with an outbreak of cholera amongst the permanent inhabitants of the City is necessary. To deal with cholera amongst famine-stricken immigrants, the immigrants must be dealt with before the disease appears. The treatment of the disease, after it has appeared, is not sufficient, because choleraic forms of disease assume a most fatal form amongst the ill-fed. The people who are likely to be attacked must be treated, and there is only one way of treating them as they arrive here famished or in a low state of health, *viz.*, to place them in camps and feed them. We have ample means and Advice to the Plague Committee how to treat Cholera amongst the destitute.



organization to effectively deal with cholera, but there is no organization to detain and feed the ill-nourished and famished people, who are coming into Bombay in thousands.

To the  
Committee.

725. I may point out that in the years following 1877, I had to charter steamers and remove by force thousands of famine-stricken people from the City. In these years there was a great immigration from Kathiawad. If, therefore, there are good grounds for apprehending that amongst the ill-fed and emaciated people returning to the City, famine types of disease may appear, arrangements ought to be at once considered for forming camps in which to detain and feed all people who appear to have suffered from the effects of privation. The first step is to ascertain from Government the numbers likely to be migrating into the city and their state of health.

726. I requested Professor Muller to give me a few notes of his experiences in the north of the Island, where he had done such zealous and admirable work in the inspection of buildings and the removal of cases to hospital. I have made a brief extract from the notes that Professor Muller has kindly prepared for me. Work such as this done out of goodness of heart cannot be too highly praised.

“ On April 1st, Surgeon-Captain Jennings and I, and a large party of the Justices of the Peace, police and sepoy, made the first visit to Dharavi. We found twelve cases and deported them with some difficulty to the Sion and Mahim Hospitals. I noted that a number of the cases had caught the infection during the Holi holidays when they had been in Bombay. The tannery owners of Dharavi, on learning that all plague cases must be taken to hospital, built a private hospital in the fields to the south of their village and undertook to form a ‘Local Committee’ to search out plague cases and take them to hospital. I, therefore, devoted my attention to the other infected parts of District No. 10.”

“ Meanwhile the plague raged at Dharavi and continued to spread, and so, on April 15th, I again visited the village and found that the ‘Local Committee’ was a mere pretence and did nothing. I met with great opposition, finding five cases. Fortunately I had taken four sepoy with me in *mufiti* who were able to prevent a disturbance. The ‘Local Committee’ promised once more to do their work.”

“ On April 23rd, the plague being practically over in the rest of District No. 10, I devoted my time almost exclusively to Dharavi, visiting it as far as possible every day. My visits were of two kinds. On one day I would go with a very large force, always in *mufiti*, surround the village and search every nook and corner. The next day I would perhaps turn up with only a single attendant and visit suspected houses or those where cases had recently occurred, and enquire into the health of the neighbours and relations of the stricken. But whether I came with a large band or went alone, my success in discovering cases depended on the rapidity of my movements which gave no time for cases to be effectually concealed, doors locked, &c. I always walked very fast and usually ran through houses, huts and chawls at a great pace.”

"The plan adopted on April, the 23rd, was the one followed whenever a  
 "complete search was made. The force consisted of 8 policemen and 14 sepoys  
 "in *mufi*. The latter moved in advance and drew a cordon right round the village,  
 "each soldier being just within hail of the next. The cordon included the  
 "Dharavi Hospital, and as, it was effective, the only escape open to a plague  
 "patient, who did not wish to be discovered in his or her home, was to go volun-  
 "tarily to the hospital, and this they often did. When the cordon was complete,  
 "the village was divided up into several long strips, usually two or three, all con-  
 "verging on the hospital. The party, which usually consisted of myself, the Police  
 "Superintendent and the Staff of the Health Department was then divided up  
 "into two or three sections, each undertaking the search of a strip, and all work-  
 "ing towards the hospital. The police not only served to show what houses  
 "had been searched by the neighbouring party, but also prevented sick people  
 "from being moved about from one strip to another. When a case was found  
 "in a room, all rubbish, clothes, &c., likely to be infected, was burnt, being first  
 "valued and paid for in cash on the spot—a procedure much appreciated by the  
 "poor; the whole place was then disinfected with perchloride of mercury and  
 "finally whitewashed, the tiles being removed where possible. All other inmates  
 "of the room were turned out and made to encamp on the rice-fields near.  
 "When several cases had occurred in a chawl, the whole place was vacated on to  
 "the fields, a process often carried out voluntarily as the people soon realized  
 "the dangers of remaining in the house. That the cordon was well kept was  
 "shown by the fact that one day two young Parsees and on another day a Euro-  
 "pean were found stopped by the sepoys. Several 'cases' too were intercept-  
 "ed in this way. The six cases discovered on April 23rd were nearly all from  
 "a part of Dharavi known as Cuchraputty, consisting of a congerie of forty huts  
 "of bamboo and jawlies crowded together in a very small space. To disinfect  
 "them was well nigh impossible. Had it not been for the order forbidding any  
 "further destruction of huts owing to the approach of the monsoon, I would have  
 "burnt the whole place at once. Day after day cases were found here. On May  
 "4th, after discovering eight cases mostly originating from this plague spot, I  
 "destroyed the whole forty huts, pulling them down and burning them, the owners  
 "being satisfied with my promise to assist in rebuilding them. The whole site was  
 "cleared and laid out in four parallel streets, and forty new huts were begun. Most  
 "of the material was obtained from the never-occupied segregation camp on the  
 "Kennedy Sea-Face. The new huts were erected in regular lines in pairs. They  
 "were large and lofty and furnished with a verandah and a good high plinth.  
 "The roofs were of jawlies and the walls of split bamboos, openings being left for  
 "windows and doors. The inhabitants meanwhile encamped in 'chuppers' on the  
 "rice fields, where, after one or two cases, the plague ceased among them. Only  
 "three more cases were discovered in the whole village and none after May 8th.  
 "I searched the whole place with a cordon round for six successive days, and,  
 "finding no cases, concluded that the plague had gone and so left on May 13th.  
 "Altogether nineteen visits were paid to Dharavi and thirty-nine cases discovered  
 "and removed. Since May 13th, there have been no cases of plague returned as  
 "occurring in Dharavi. I have visited the village once a fortnight since June, and  
 "have found nothing of the nature of plague, the people telling me freely of, and  
 "taking me to see, any who are sick in the village."

## Result of Inspections in the north of the Island :—

Serial Number of Visits.	Date of Search.	Number of Cases found.	REMARKS.
	1897.		
1	April 1st ... ..	12	
2	„ 15th ... ..	5	
3	„ 23rd ... ..	6	
4	„ 24th ... ..	2	
5	„ 25th ... ..	.....	
6	„ 26th ... ..	2	
7	„ 27th ... ..	.....	
8	„ 30th ... ..	1	
9	May 2nd ... ..	.....	
10	„ 4th ... ..	8	
11	„ 5th ... ..	1	
12	„ 6th ... ..	.....	
13	„ 7th ... ..	2	
14	„ 8th ... ..	.....	
15	„ 9th ... ..	.....	
16	„ 10th ... ..	.....	
17	„ 11th ... ..	.....	
18	„ 12th ... ..	.....	
19	„ 13th ... ..	.....	
		39	Cases discovered and removed to hospital.

727. On the 27th of July I wrote a circular to the medical men in the City, asking them to inform me of any cases of fever accompanied by broncho-pneumonia that might come under their notice, and in which they might consider it advisable to have a bacteriological examination of the blood. A recrudescence of Bubonic Plague as I had anticipated in June had I believed at this time taken place.

728. I have now finished my review of the rise, progress, and decline of the Epidemic of Bubonic Plague in Bombay.

T. S. WEIR,  
Health Officer.

Return of Staff employed in the Health Department on the 31st March 1897.

Sections.	Deputy Health Officers.	Medical Officers.	Inspectors.	European Sub-Inspectors.	Native Sub-Inspectors.	Muster Clerks.	Muccadams and Patels.	Siches Muccadams.	Registration Kar-koons.	SEW. ESTABLISHMENT.			URINE CLEANING ESTT.			HALALCORES' ESTABLISHMENT.			FLUSHING ENGINE STAFF.				Horse Drivers.	Grave Diggers.		
										Cart Drivers.	Men.	Women.	Cart Drivers.	Men.	Women.	Trip Markers.	Muccadams.	Halalcores Men and Women.	Cesspool cart-drivers.	Sub-Inspectors.	Muccadams.	Drivers.			Men.	
A { Upper Colaba ... ..	...	...	...	1	1	...	1	...	1	10	13	8	...	...	...	...	1	17	...	...	...	...	...	...	...	...
	Middle and Lower Colaba. ... ..	1	...	...	3	...	1	...	...	9	13	8	4	...	...	...	3	37	19	...	...	...	...	...	...	...
	Fort Southern ... ..	...	...	1	1	...	4	...	1	15	36	17	17	...	...	...	3	53	...	...	...	...	...	...	...	...
	Fort Northern ... ..	...	1	...	...	3	...	7	...	1	36	63	30	11	...	...	...	5	59	...	...	...	...	...	20	...
Esplanade ... ..	...	...	...	...	3	...	4	...	1	13	30	11	4	...	...	...	3	29	...	...	...	...	...	...	...	...
B { Mandvi ... ..	...	1	1	1	7	3	7	...	3	56	96	35	15	21	17	1	4	65	...	...	...	...	...	...	13	...
	Chuckla ... ..	1	...	1	2	...	5	...	...	17	54	23	10	10	5	...	2	48	...	...	...	...	...	...	...	...
	Umarchadi ... ..	1	3	...	1	6	...	9	...	3	19	75	36	14	27	14	4	46	1	...	...	...	...	...	30	...
	Dongri ... ..	...	1	...	2	3	...	5	...	3	10	57	23	7	16	8	3	63	1	...	...	...	...	...	...	...
C { Market ... ..	...	1	...	2	2	...	9	...	2	23	38	27	12	15	7	...	3	87	...	...	...	...	...	...	...	...
	Dhobi Talao ... ..	...	...	...	4	...	4	...	...	18	37	21	11	17	16	...	3	68	...	...	...	...	...	...	...	...
	Fonaswadi ... ..	1	1	1	3	1	3	...	1	12	96	11	8	16	10	...	2	49	1	...	...	...	...	...	20	...
	Wankeshwar ... ..	...	...	...	2	...	8	...	2	16	38	23	12	21	13	...	3	64	...	...	...	...	...	...	...	...
	Khara Talao ... ..	...	...	...	2	...	4	...	2	10	19	17	6	12	5	...	2	38	...	...	...	...	...	...	...	...
Kumbharwada ... ..	...	...	...	1	2	...	4	...	2	7	17	12	6	13	6	...	2	36	...	...	...	...	...	...	...	...
D { Khetwadi ... ..	...	1	1	1	2	2	6	1	1	15	39	17	5	6	5	...	5	64	1	...	...	...	...	...	20	...
	Girgaum ... ..	...	...	...	3	...	4	...	1	10	30	12	4	3	2	4	4	52	...	...	...	...	...	...	...	...
	Chauupati ... ..	...	1	...	1	...	4	...	1	5	15	6	2	4	3	...	2	25	2	...	...	...	...	...	...	...
	Wankeshwar ... ..	...	...	...	2	...	6	...	1	15	31	12	1	3	2	...	3	91	...	...	...	...	...	...	...	...
Mahalakshmi ... ..	...	...	...	1	4	...	7	...	...	9	27	11	3	5	4	...	3	87	18	...	...	...	...	...	...	
E { Mazagon ... ..	...	2	...	2	4	...	5	...	2	10	70	21	8	11	10	1	4	87	24	...	...	...	...	...	...	...
	Farwadi ... ..	1	...	2	4	...	4	...	1	11	62	20	7	7	7	1	4	65	10	...	...	...	...	...	...	...
	2nd Nagpada ... ..	...	...	1	3	...	2	...	1	9	33	15	4	11	6	...	3	33	...	...	...	...	...	...	...	...
	Kamathipura ... ..	1	3	1	3	2	5	2	1	16	64	44	6	5	5	1	3	47	...	1	...	...	...	23	...	...
	Tardeo ... ..	...	...	...	1	...	3	...	1	9	25	17	4	3	3	...	2	40	3	...	...	...	...	...	...	...
	Bycenla ... ..	...	1	1	3	7	1	10	...	1	14	87	48	6	10	7	1	6	82	2	...	...	1	1	20	...
1st Nagpada ... ..	...	...	...	1	8	...	2	...	...	4	18	10	3	7	4	...	2	23	...	...	...	...	...	...	...	
F { Parcel ... ..	...	1	1	1	4	1	6	1	1	10	25	10	4	8	6	1	4	89	10	...	...	...	...	...	...	...
	Sewri ... ..	...	...	...	2	...	2	...	...	7	23	10	3	6	6	...	2	44	6	...	...	...	...	...	...	...
	Sion ... ..	...	...	...	5	...	3	...	1	4	23	10	3	5	4	...	2	55	8	...	...	...	...	...	...	...
G { Mahim ... ..	...	1	...	...	7	1	6	1	1	11	56	24	4	9	9	...	5	90	11	...	...	...	...	...	...	...
	Worli ... ..	...	...	...	2	1	1	...	1	5	23	9	3	8	4	...	2	54	4	...	...	...	...	...	...	19
General ... ..	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ... ..	5	23	7	36	105	14	151	10	39	434	1,314	605	207	325	206	11	95	1,773	121	1	2	1	133	13	19	

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**Report on Bubonic Plague Cases treated at the Arthur Road Hospital from September 24th, 1896, to February 28th, 1897.**

**I.—ADMINISTRATION.**

1. The Arthur Road Hospital occupies a central position in the island of Bombay and is easily accessible from all directions, both on account of its location near Jacob's Circle, where the principal roads from the city converge, and its close proximity to the Mahalakshmi and Chinchpokli stations and the tramway terminus. An extensive area of open land surrounds it on all sides, and the only habitable buildings near it are situated at a distance and to the south and south-west and none are to the windward of the Institution.

The Hospital itself faces the west and is open directly to the sea breeze ; no buildings intervene between it and the sea,—the Municipal Dhobie-vada, the B. B. & C. I. Railway lines, the race-course, the storm water reservoir and the Hornby Vellard occupying the intervening space. To the north and north-west some of the mills are located, and to the east there is open ground and a tank. A small collection of water also exists between it and the Dhobie-vada.

2. The Hospital consists of three open sheds with a stone plinth and a tiled roof with ridge ventilation, supported on iron columns and earthen flooring. They are usually closed in with bamboo and mat frames. The size of each of the sheds is 117 feet by 40. Each shed has two self-flushing water closets attached to it, separated by a twelve-foot passage. The sheds are placed end to end from north to south and have the full advantage of the westerly breeze. Besides these permanent structures, there is a dispensary and quarters for one Hospital Assistant in one block, rooms for three or four servants in another block, a cook-room, a mortuary and a water-closet for the servants.

3. The water-supply is from the Vihar main, and the drainage system is the water carriage system both for solids and fluids. The compound is well supplied with surface drains.

4. Up to the outbreak of Bubonic Plague and for the first 3½ months of the epidemic the Institution met all the demands made upon it, and they as a rule were not very heavy.

The number of patients treated varied from year to year, the largest number treated in any one year, except 1896, was 336 in 1892. During the early part of this year, however, the demands made upon the Institution were extraordinary as shown by the fact that during January and February 1897, 642 plague cases were treated. These facts alone demonstrate the excessive strain that was put upon the resources of the Institution, and it becomes still more

evident when contrasted with the ordinary work of the previous years as shown in the following table :—

Years.	No. of patients treated.	Period during which Hospital was open.
1888 ... ..	45	4 months.
1889 ... ..	102	6 „
1890 ... ..	123	1 month.
1891 ... ..	91	7 months.
1892 ... ..	336	Whole year.
1893 ... ..	214	Do.
1894 ... ..	322	Do.
1895 ... ..	205	Do.
1896 ... ..	775	Do.
January & February 1897.	642	—

The large number of patients treated in 1896 is principally accounted for by the admission of 303 small-pox and 297 plague patients.

5. The usual establishment at the Hospital throughout these years consisted of one Medical Officer, one Resident Hospital Assistant, three to six ward boys (according to the number of patients), one ayah, one cook, one or more sweepers, one biggary, one night and day duty Ramosees (at times), and it sufficed for all the needs of the Institution. The number of ward servants, sweepers, &c., was increased or diminished according to requirements.

6. The Hospital sheds are capable of accommodating one hundred patients, but hitherto such accommodation had never been required. Provision was usually made for about two dozen patients, but as soon as plague patients began to be admitted ample stock and materials were kept ready for about 80 and subsequently 150 beds.

7. The first plague patient was admitted on the 24th September 1896, and two more followed before the end of the month. In October, there were 85 admissions and in November only 27. Extra assistance in the shape of Hospital Assistants and ward servants was sanctioned by the Municipal Commissioner and the Executive Health Officer, and two Hospital Assistants, placed on plague duty by Government with the Bombay Municipality, were attached to the Hospital. The number of ward servants in October was 8 (7 ward boys and one ayah), and during November the staff continued the same with the exception of two ward boys who left the service on account of their having had to work among plague patients. In December, 182 patients were admitted, in January 1897, 277, and in February 365. The number having increased so largely and so suddenly taxed to the utmost the zeal and ability of all concerned, but the Hospital Assistants and the ward



servants, short-handed as they were, successfully attended to the nursing of the patients. The number of ward servants was increased to 10 in December, to 12 in January and to 15 in February; and in addition to this, extra men, such as sweepers, cooks, &c., were employed. The following statement gives the particulars of the establishment from month to month:—

	Medical Officer.	Hospital Assistants	Ward Boys.	Ayahs.	Cooks.	Sweepers.
September 1896 ... ..	1	1	2	1	1	1
October " ... ..	1	2	7	1	1	2
November " ... ..	1	3	5	1	1	2
December " ... ..	1	3	9	1	2	2
January 1897 ... ..	1	3	11	1	2	3
February " ... ..	2	4	12	3	3	6

The proportion which the ward attendants bore to the number of patients in the Hospital can therefore be easily determined by taking the daily average and contrasting the same with the number of servants:—

	Daily average number of patients.	Number of ward servants.	One servant to
September 1896 ... ..	5.43	3	2 patients.
October " ... ..	23.54	8	3 "
November " ... ..	15.16	6	2 "
December " ... ..	35.35	10	3½ "
January 1897 ... ..	71.70	12	6 "
February " ... ..	109.67	15	7 "

8. Every effort was therefore made to secure additional servants, but in spite of the continuous efforts of the authorities to procure them even on double or treble pay the greatest difficulty was experienced. There was extreme reluctance on the part of men, who had never been in their lives inside an Hospital to take service, especially in a Plague Hospital, and when asked, they openly said that they would not endanger their lives under any consideration; some, however, were induced to join but only worked for a few hours or days and then ran away, never even coming to claim their wages. The number and the frequency of deaths, combined with the delirious condition of patients used to frighten them, and indeed the sights and sounds of a plague ward in the dead of the night, with the groans and moanings of the delirious patients were enough to appal the stoutest heart. Old servants could with difficulty be induced to remain, and a majority of them on that account went on strike and refused to work. All of them were given a bonus to make them continue in service, and their pay all round had to be increased. They were asked to induce some of their own friends to take up work in the Hospital but to no purpose. They used to come, work for a short time and run away as before. Pay, however large, was no inducement. They had never seen so many people dying as they did in the plague, for the largest number died at the Arthur Road Hospital, both because of the numerous admissions and because so many cases were brought in a moribund condition. It was not till March when the epidemic commenced to decline that a considerable number could be induced

to join, and strange to say amongst the latter were some people who had attended their sick friends in the Hospital. The men who stuck to their posts during these trying months worked most zealously. The three Hospital Assistants worked practically night and day, I myself putting in from six to eight hours' work every day. The strain was terrible, and it is indeed a source of wonder when thinking calmly over those days to realise how the whole staff passed safely through such critical times.

9. Early in February the patients commenced to be brought to Hospital in large numbers, and the daily admission rate fluctuated between ten and twenty-two, the largest number of patients in Hospital on any one day being 136 on the 16th of February. Stores and other equipment were indented for in proportion from the beginning of the month. There was, however, one day a sudden rush of patients, and two families consisting of about 12 persons were sent to the Hospital at about midnight. All the available cots having become exhausted during the previous 24 hours' admissions, which were heavy, some of the patients had to be accommodated on the floor for a few hours, warm blankets, sheets, pillows, &c., being provided for them. On reaching the Hospital early in the morning I was informed about the state of affairs, and I immediately obtained a loan of a few cots from the Jain Hospital in the compound and had them made comfortable within a few minutes. This was the single occasion on which the hospital accommodation for a few hours was insufficient and extension and further accommodation was at once put in hand. Every patient had his allotted meed of attention, and the system of stock mixtures and routine treatment, dieting, &c.—the only rational and practicable system in such times—was adopted to ensure due attention to each and everyone and at the same time to lessen the worry and burden of the work on the overtaxed staff.

10. The floors of the Hospital came in for a good deal of adverse criticism, but by a liberal use of strong disinfectants, especially solutions of carbolic acid and corrosive sublimate, the risk of infection from them was to a great extent minimised, and in no single instance were any of the ward servants, sweepers, friends of patients (almost all of whom used to go about bare-footed) infected. The Arthur Road establishment was not an ideal infectious diseases hospital in some respects, and might have been considerably improved upon, but its fine site and the free ventilation from the open sea breeze that it provided—*sine quâ non* in such a disease as Bubonic Plague—rendered it admirably suited for the purpose for which it was intended, and all the Europeans, members of the various Plague Commissions and others who visited the hospital envied Bombay in possessing such an open and well situated institution. Experts have been and are still at variance as to the best building for an infectious diseases hospital, and opinion was pretty equally divided amongst the savants as to whether a permeable and frequently renewed flooring or a permanent one was best for a tropical climate—although a majority seemed to favour the latter view as being more economical, less risky and better in appearance. One shed has already been experimentally paved with Indian Patent stone. As regards bamboo matting, some favoured a structure that could be destroyed, whilst others were in favour of a more substantial arrangement. The sheds were re-arranged as regards their enclosure: 8 feet verandahs were

left all round and mat frames of a different pattern were affixed in one ward, and in the two others deal-wood planking frames, well painted, were fixed. It is yet too soon to speak about the relative merits of this arrangement. A small cadjan shed for 12 patients was erected in the compound in December, and two large cutcha wards, each 100 feet by 40 feet, were commenced early in February so as to increase the total accommodation of the Hospital to 150 beds. Additional buildings were taken in hand during February for the accommodation of the Sisters of All Saints, and other nurses, as well as for the additional ward servants and others.

11. Apart from the difficulties above referred to, the Hospital had to contend against the ignorance and prejudice of the people, always averse to going to a Hospital, and more so when sent there against their will and under compulsion. Time after time patients in a moribund condition were brought to the Hospital, to whom no relief could be given, as they were practically past all help, and they came simply to die, the Hospital getting all the popular discredit attached to the heavy mortality. Nearly one-third of the total admissions during the six months died within 24 hours of admission, by far the greater number dying within a few hours and some even within a few minutes. At times patients were found dead when brought to Hospital in ambulances, and the corpses were sent direct to the burning grounds. Added to this heavy mortality, the means used to resuscitate and support their strength, especially subcutaneous injections, were misconstrued, and it was openly said that the doctors were killing the patients in order to stop the further ravages of the epidemic. It was also freely stated that the patients were purposely killed and their hearts taken out in order to send them to Her Majesty the Queen-Empress to appease her wrath, on account of the disfigurement of her statue, which occurred in the beginning of the epidemic. All this culminated in a raid on the Hospital in the forenoon of 29th October 1896, when a large number of mill-hands, estimated from 800 to 1,000, rushed towards the Hospital, breaking open the gates, and scaling the walls with a view to wreak their vengeance on the Hospital staff for the alleged killing of patients. Road metal was freely thrown at the Hospital staff, some of which, reaching the wards, broke the tiles and injured some patients, but fortunately no one was seriously hurt; on learning that the Police were approaching, the men dispersed in all directions. An armed Police guard had to be quartered on the premises for a long period, and Arthur Road, which is one of the main roads leading to the mills, was patrolled by mounted and foot police for a considerable time after the raid. The Hospital Assistants were openly threatened with violence; they dared not go out of the compound for their meals, &c., unless shadowed by policemen in plain clothes, and it was under such conditions that the work of the Hospital was conducted for some two months.

12. The relatives and friends of patients were freely welcomed on all occasions, under the belief that they would supplement the efforts of the nursing staff, and though a good deal of noise was created on the score of their being not allowed to visit the patients, exactly as they liked, it was found, when it came to practical test of their feelings, that they were in the majority of cases so

terror-stricken as not to care to venture within the gates, once the patient was admitted to the Hospital. Most of the clamour raised was due, not to their being forbidden to see their friends, but on account of their having been taken to the Hospital under compulsion. In only a few cases did they stay and nurse the patients throughout their illness. A large number tarried for a short time, not out of any consideration for the patients, but with the sole object of eliciting information from the sick as regards their belongings, property, &c., whilst in other cases they simply came to relieve the patients of all the valuables on their persons, and never appeared again, to inquire after them, or give them a decent burial when they died. All family ties and ties of kinship appeared to have been forgotten for the time being, and husbands deserted their wives and *vice versa*, and even children were deserted by their parents. Often children were brought to the Hospital by their parents, who gave a purposely wrong address and could not be traced afterwards, having gone away for good, after leaving them at the institution. And in fact during this period, 338 dead bodies of plague patients were disposed of at municipal expense, the largest number being for December, January and February—62, 88 and 179, respectively. All these were not pauper patients in the strict sense of the term, for a good many of them had means or connections who could have discharged their duty to the dead instead of getting it done at public expense. These 338 bodies so disposed of belonged to the Hindoo and Mahomedan communities alone, a large number of Native-Christian and Goanese corpses having been disposed of by the Fathers of the Dabul Church under instructions from the Very Reverend Vicar-General.

As to any help in nursing from the friends of patients, their presence, though it may have been a comfort, very often proved disastrous to the sick, for they frequently disturbed the patients when quiet was a paramount necessity, and it was not at all unusual to detect them in the act of surreptitiously inserting boluses of lumpy rice between the lips of semi-moribund cases. Any real help from such a quarter was entirely exceptional.

Several orphans belonging to various communities were left on our hands after being cured, and some of them were adopted and taken away by charitably disposed persons, whilst others were entrusted to the charge of the Sisters of All Saints, who very kindly undertook to look after them.

13. In every case where dead bodies were claimed by the relatives or friends of patients they were handed over to them for disposal and in no case was there refusal or the slightest reluctance on the part of the Hospital Staff to give them up, no grounds therefore existed for complaint on this score. It was a mere canard that the Doctors cut up the dead bodies and did not return even the dead to their kinsmen. But it appeared that as the epidemic increased in intensity, the zeal of the kinsmen waned proportionately, for out of the 43 deaths that occurred in October, during the commencement of the epidemic all except 4 bodies were claimed by the friends. In November out of 20, 5, *i.e.*, a fourth,

were disposed of at Municipal expense, and the figures for December, January and February stand as follows :—

Months.	Deaths from Bubonic Plague.	Bodies disposed of at Municipal ex- pense exclusive of Christians.
December ... ..	132	62
January ... ..	182	88
February ... ..	287	179

Whenever there was a death, every possible effort was made, so far as time permitted, to inform the connections of patients if known, and a reasonable time was allowed for them to come for the burial, but failing this, the body had to be disposed of, as on account of the daily heavy mortality the corpses could not be allowed to accumulate and decompose for an indefinite period.

Sometimes friends used to turn up some hours after disposal and were informed accordingly ; often they only came for inquiry from a fortnight to three months after the death of the patient—sometimes for certificate of death in order to claim insurance money, &c., at others, to claim any effects left by the patient. Whatever the patient possessed was taken charge of and delivered over to him if he recovered or to his friends or relatives in case he died, but in most cases patients brought very little with them to the Hospital.

14. Such, in brief, is the administrative history of the Arthur Road Hospital as a Plague Hospital. Up to February the work with all its attendant details of administration, organisation, equipment, provisioning, &c., added to the purely medical work fell upon the Medical Officer, who for a considerable period was single-handed, and his staff, and besides these duties, multifarious as they were, a good deal of time had to be devoted to visitors from every part of India and all parts of the world. But this was not all. The Plague Epidemic had suddenly created in our midst a host of pseudo-specialists who pretended to know all about the Plague, and who for a time, forgetting their usual avocations of Tramway Conductors, Railway Guards, Engineers, Postal Inspectors, Clerks, &c., suddenly blossomed forth into Plague specialists, vaunting their nostrums day after day, and pestering the Health Officer as well as the Medical Officer of the Hospital. Then again, the permanent quacks had their specialities, and in some cases even duly qualified medical men, who ought certainly to have known better, came out with strings of prescriptions and specifics with the view of obtaining a fleeting notoriety. The late Dr. P. N. Davda was appointed early in February to assist me, and he discharged his duties in an extremely praiseworthy manner, till his sad and untimely death from Bubonic Plague at the Arthur Road Hospital on the first of May 1897. Doctors Pilgaonkar and Miss Maneck Tarkhad volunteered to assist me during the most trying period of the epidemic, and I need hardly say that their timely help proved to me of extreme value, and I cannot sufficiently thank them for the valuable aid they rendered me, and for

their public spirit and zeal in so disinterestedly coming forward to undertake such risky and onerous work. Doctors Moon and C. F. Underwood also assisted me for a short time, and I am grateful to them for their help.

15. The nursing was placed under the charge of the Sisters of All Saints on the 6th of February, and no words could suffice to eulogise the devotion and the zeal they brought to bear on the nursing of plague patients at no inconsiderable personal risk and sacrifice. It is not possible to imagine what the state of the Hospital would have been without their timely aid at the most critical period of the epidemic. Their work in connection with plague operations will always remain a bright chapter in the annals of the Sisterhood, and they have laid this city under a deep debt of obligation to them. Miss Atkinson of Cama Hospital also joined the Sisters in this work, and Mr. Richardson, F.C.S., Ph.D., assisted for a considerable period in nursing the patients, both before and after the Sisters took charge.

16. Of the hospital staff, the Assistant Medical Officer, Dr. P. N. Davda, and three ward boys, were attacked with plague; Dr. P. N. Davda succumbed to the affection, and his death was a real loss to the Institution. All the ward boys recovered—two of them suffered from a mild and one from a moderately severe form of the disease.

17. The scope of the appended Medical Report is strictly clinical, being a summary of observations made on the cases treated in the Hospital. It does not lay claim to be an exhaustive or detailed study of the disease, and consists of such superficial observations as the limited time at the disposal of the Medical Officer would permit of. It may, however, be considered to embrace such of the principal points as were worth noting and recording, and are likely to prove useful for future reference.

## II.—Statistics.

18. The following statistical statements are prefixed to give a general idea of the work done at the Hospital during the period :—

TABLE I.

Months.	Number of patients admitted.	Died within 24 hours.	Died within 48 hours.	Total Deaths.	Recovered.	Percentage of total mortality.	Percentage of mortality excluding the deaths within 24 hours.
September and October 1896	88	17	10	46	42	52·23	40·84
November 1896 ... ..	27	9	3	18	9	66·67	50·00
December ,, ... ..	182	60	63	135	47	74·12	61·47
January 1897 ... ..	277	90	43	191	86	69·00	54·00
February ,, ... ..	365	130	46	298	67	81·64	71·48
	939	306	165	688	251	73·26	60·34

19. Table No. I shows that the total number of patients treated during the period was 939, of whom 688 died and 251 recovered, giving a mortality rate of 73·26 per cent. Of the total deaths, 306 occurred within the first 24 hours, and 165 during the next 24 hours, *i.e.*, nearly more than two-thirds of the total mortality occurred within 48 hours of admission. If the mortality of the first 24 hours be excluded from computation, the mortality rate would stand at 60·34 per cent. of the number treated. It is a striking feature in the epidemic that during November, December, January and February, exactly a third of the total admissions should have died within the first 24 hours. As regards the 24 hours following, the ratio however is not the same. It appears that in December, with a total mortality rate of 74·12 per cent., a third more of the total admissions should have died, whereas in February with a higher mortality rate of 81·64 per cent. and in January with a lower rate of 69·00 per cent., the number of deaths within the second 24 hours should have been equal. Evidently patients lived a little longer in January and February than in December, but with this difference that the longer period gave a better recovery rate to the extent of 5 per cent. in January, whereas in February the same causes increased the death-rate by 7·50 per cent. over December. On comparing the mortality of various months, September and October have the least mortality (52·23 per cent.); then comes November with 66·67 per cent., and which is followed by January, December and February with 69·00, 74·12 and 81·64, respectively. This clearly indicates a progressive rise in the intensity of virulence of the virus from September onwards up to the end of February, when it seems to have reached its maximum. It is found, on the comparative statistics of March, April and May that the mortality rates for these three months stand at 67·35, 56·66 and 38·46 per cent. respectively, thus indicating a decadence in the severity of the epidemic.

TABLE II.

	No.	Died.	Recovered.	Percentage of mortality.
Hindus ... ..	693	523	170	75·46
Mussalmans ... ..	119	79	40	66·33
Native Christians ... ..	116	78	38	67·24
Parsees... ..	7	5	2	71·42
Israels ... ..	4	3	1	75·00
Total ... ..	939	688	251	73·26

20. Table No. II gives the details of the patients treated during the period, from which it appears that Hindus constituted more than two-thirds of the total admissions (693), the rest being made up of Mussalmans (119), Native Christians, mostly Goanese (116), Parsees (7), and Israels (4). The mortality amongst the Hindus, as a class, was very heavy, namely 75·46 per cent. of those treated, whereas Mussalmans had a mortality of 66·33 per cent. and Native Christians 67·24 per cent. The number of Parsee and Israel patients being so limited, no comparison can be instituted between them and the rest of the patients. What, however, strikes one most is the fact that Mussalmans and Native Christians—both meat-eating communities, should show an almost equal mortality rate from an almost

equal number of patients. No deductions can, however, be drawn from such scanty figures, but when the statistics of the total mortality are made up, it would be interesting to find out whether the meat-eating communities had a stronger power of resistance and consequently lower mortality than the non-meat-eating castes.

TABLE III.

## (a) Hindus.

	Number.	Died.	Recovered.	Percentage of mortality.
Males ... ..	554	423	131	76.35
Females ... ..	98	73	25	74.49
Children ... ..	41	27	14	65.85
Total ... ..	693	523	170	75.46

## (b) Mussalmans.

	Number.	Died.	Recovered.	Percentage of mortality.
Males ... ..	103	66	37	64.07
Females ... ..	14	11	3	78.57
Children ... ..	2	2	.....	100.00
Total ... ..	119	79	40	66.38

## (c) Native Christians.

	Number.	Died.	Recovered.	Percentage of mortality.
Males ... ..	88	57	31	64.77
Females ... ..	23	18	5	78.26
Children ... ..	5	3	2	60.00
Total ... ..	116	78	38	67.24

## (d) Parsees.

	Number.	Died.	Recovered.	Percentage of mortality.
Males ... ..	6	4	2	66.66
Females ... ..	1	1	.....	100.00
Children ... ..	.....	.....	.....	.....
Total ... ..	7	5	2	71.42



## (e) Israels.

	Number.	Died.	Recovered.	Percentage of mortality.
Males ... ..	4	3	1	75·00
Females ... ..	.....	.....	.....	.....
Children ... ..	.....	.....	.....	.....
Total .	4	3	1	75·00

21. Table No. III contrasts the admissions by castes, together with the sexes, and here too comparison can only be instituted between the Hindus, Mussalmans and Native Christians. Hindu males had a much higher mortality rate than either Mussalmans or Native Christians. The latter having almost the same rate, 64·07 and 64·77 as against 76·35 per cent. in the former—a difference of over 12 per cent. This, however, does not hold good in the case of females, and, strange to say, Hindu females show a lower mortality rate by almost 4 per cent. (74·49) than Mussalman or Native Christian females, in whom the rates are 78·57 and 78·26 per cent., *i.e.*, even higher than the Hindu male death-rate. It may be that this is due to the female admissions being so comparatively few in these communities. In the case of children, it is noticeable that the number of Mussalman and Native Christian children is too limited for purposes of comparison, but Hindu children show a lower mortality rate than adult males or females (65·85 per cent.), which is almost about the same as that of the adult males of the two other communities.

As regards the various classes of Hindus admitted, it may be stated that the majority consisted of Deccani and Kokani Mahrattas, about 500. The Purdeshees followed next with about 141 admissions—almost all males. These are as a rule men of good physique and come to Bombay from Upper India in search of work. They are mostly employed as syces, dhobies, gowlees or milkmen, coachmen, in the mill industry, and in miscellaneous employments, such as hawkers and sweetmeat sellers.

Although they have a better build and appear stronger than the Deccani Mahrattas, they are almost invariably under-fed, and therefore not so capable of resisting infection. Their stamina is very low and consequently the mortality amongst them was very heavy. Of the 141 Purdeshees admitted, 115 died, giving a mortality rate of 81·56 per cent., but comparing them by the occupations they followed, it is seen that the heaviest mortality was amongst the syces (89·47 per cent.), then come gowlees or milkmen with 86·66, then those following miscellaneous trades, 84·00, and lastly dhobies, mill-hands and coachmen with 78·57, 78·00 and 77·77 per cent., respectively.

The rest of the Hindus, about 52 in number, were made up of Shenvees, Purbhus, Deccani and Gujarati Baniyas, Lohanas and a few Bhatias, and only one high-class Brahmin from Dharwar.

TABLE IV.

No.	Occupation.	Number of admissions.	Died.	Recovered.	Percentage of Mortality.
1	Ayah ... ..	14	12	2	85·71
2	Baker ... ..	3	2	1	66·66
3	Barber ... ..	8	7	1	87·50
4	Basket-maker ... ..	2	1	1	50·00
5	Beedi-seller ... ..	1	.....	1	00·00
6	Beggars ... ..	155	121	34	78·66
7	Blacksmith ... ..	2	2	.....	100·00
8	Butcher ... ..	5	4	1	80·00
9	Butler ... ..	13	11	2	77·00
10	Carpenter ... ..	8	8	.....	100·00
11	Cart-driver ... ..	7	7	.....	100·00
12	Clerks ... ..	5	3	2	60·00
13	Coachmen ... ..	18	14	14	77·77
14	Compositor ... ..	5	3	2	60·00
15	Cook ... ..	50	36	14	72·00
16	Coolie ... ..	163	117	46	71·70
17	Cotton cleaner ... ..	1	1	.....	100·00
18	Dhobee ... ..	14	11	3	78·57
19	Dyer ... ..	1	1	.....	100·00
20	Fishermen ... ..	2	1	1	50·00
21	Fitter ... ..	4	2	2	50·00
22	Goldsmith ... ..	6	4	2	66·66
23	Gondlee (singer, religious) ... ..	1	1	.....	100·00
24	Gowlees (milkmen) ... ..	15	13	2	86·66
25	Hawker ... ..	7	4	3	51·14
26	Lascar (Arsenal) ... ..	1	.....	1	00·00
27	Lascar (Fire Brigade) ... ..	4	3	1	75·00
28	Ma'ee ... ..	11	9	2	81·81
29	Mason ... ..	1	.....	1	00·00
30	Mill-hand ... ..	101	78	23	77·22
31	Painter ... ..	5	4	1	80·00
32	Peon ... ..	9	7	2	77·77
33	Policemen (Railway Police) ... ..	17	12	5	70·58
34	Polisher ... ..	1	1	.....	100·00
35	Printer ... ..	6	5	1	83·33
36	Private, Native Regiment ... ..	2	1	1	50·00
37	Railway Servant ... ..	3	1	2	33·33
38	Sailor ... ..	4	2	2	50·00
39	School-boy ... ..	8	4	4	50·00
40	Servant (Domestic) ... ..	139	91	48	65·47
41	Shoemaker ... ..	7	4	3	57·14
42	Shopkeeper ... ..	14	10	4	71·42
43	Sweeper ... ..	6	5	1	83·33
44	Sycc ... ..	19	17	2	89·97
45	Tailor ... ..	15	12	3	80·00
46	Ward-boy ... ..	1	.....	1	00·00
47	Weaver ... ..	5	3	2	60·00
48	Wool-cleaner... ..	2	.....	2	00·00
49	No occupation ... ..	47	32	15	78·08
		939	688	251	73·26

22. Table No. 4 gives particulars of the patients admitted and their mortality rate according to their occupation. They have been divided into 48 classes ; those without occupation forming the 49th class ; but as in the majority of these the number is small, only 16 classes have been compared, and in these the admissions ranged from 11 as in the case of malees to 163 in that of coolies. It appears that the lowest mortality was amongst domestic servants—65·47 per cent. and the highest amongst syces—89·47 per cent. The following table contrasts the mortality rates between these two limits :—

Occupation.	Mortality rate.
1. Domestic Servant ... ..	65·47
2. Policeman ... ..	70·58
3. Shopkeeper ... ..	71·42
4. Coolie ... ..	71·70
5. Cook ... ..	72·00
6. Butler ... ..	77·00
7. Mill-hand ... ..	77·22
8. Coachman ... ..	77·77
9. No occupation ... ..	78·08
10. Dhobee ... ..	78·57
11. Beggar ... ..	78·66
12. Tailor ... ..	80·00
13. Malee ... ..	81·81
14. Ayah ... ..	85·87
15. Gowlee ... ..	86·66
16. Syce ... ..	89·47

The difference in the mortality rates of the occupations above enumerated is very striking, and it indicates that people who are as a rule better fed as the first five or six classes are, have a better chance of getting over the infection than those not similarly situated. The heavy incidence of mortality amongst the Purdeshees has already been referred to in a previous para, and the above table, if anything, strengthens the deduction arrived at therein. In fact gowlees and syces appear to be much worse fed than coolies, whereas dhobies, beggars, and those without any occupation are about on a par.

### III.—Clinical Report.

#### I.—THE NATURE OF CASES.

23. General reference has already been made in the first part of the report as to the nature of the cases admitted. That the Hospital was, in a large proportion of cases, a temporary halting-place between the house and the burning or burial grounds is apparent as well from the high mortality of 73·26 per cent., as from the fact that more than a third of the cases admitted were in a moribund condition, and that, out of the total mortality, more than two-thirds occurred within 48 hours of admission. Such cases were, as a rule, either of the intensely virulent type, or of patients who had been neglected and uncared for prior to their arrival in Hospital.

24. Most of the patients were brought to the Hospital in municipal ambulances or hack gharries. Occasionally a patient might come in walking all by himself or accompanied by friends. And, strange to say, on more than one occasion patients in a serious condition have walked down to the Hospital seeking voluntary admission, and have died within a few hours. A striking instance of this was the case of a Hindoo goldsmith, who came on foot all the way from Fanaswadi, was admitted at his own request and was found to be suffering from axillary buboes and double pneumonia and who died within 24 hours of admission. Surprise has been so often expressed that patients who had been apparently well should have been stricken with the disease and have died within 24 hours of the first appearance of symptoms, that several such cases were carefully noted and examined, and most of them were found to be suffering from a virulent type of Plague, specially amongst those classes of people whose life conditions are unfavourable to their successfully combating the disease.

25. As a rule, most of the cases admitted were well marked and well pronounced—in fact, were so extremely grave that the various scientific investigators, when desirous of studying the disease in its worst type and in the most serious condition, resorted to the Arthur Road Hospital. There were hardly any cases of a mild type, and, amongst some of those that recovered, the symptoms were so grave as scarcely to lead one to a hope of the patient's recovery.

#### II.—TYPES OF PLAGUE.

26. Various classifications of the affection have been made by different observers, some even going the length of minute subdivision of cases according to the severity of the virus on one or other system of the body. But for practical purposes such a classification would be cumbersome and misleading. From the

cases observed in the Hospital and elsewhere, the following principal types may be mentioned :—

1. *Pestis, Minor, or Extremely Mild Plague.*
2. *Pestis Ambulans.*
3. *Pestis Simplex Bubonica, or Simple Bubonic Plague.*
4. *Pestis Septica or Septic Plague.*
5. *Pestis Pulmonalis, or Pneumonic Plague.*
6. *Non-typical Forms of Plague.*

Besides the above, two other forms of Plague—Abdominal and Laryngeal or Diphtheritic—have been mentioned; no cases of the abdominal type have been observed in this Hospital. The laryngeal type, if it could be so called, was observed not so much as a distinct entity, but more as an advanced form of deep cervical buboes, with infiltration in the connective tissue of the neck, spreading right on up to the pharynx and larynx, and involving them in the same process. But no cases of a simple laryngeal type were observed.

#### 1. *Pestis Minor or Extremely Mild Plague.*

27. Scarcely any cases of this type were seen in the Hospital, but as the classification would be incomplete without referring to the same, it may as well be described. This form of plague is generally ushered in with slight febrile re-action, lasting from a few hours to a day or two, accompanied by general *malaise*, pain and tenderness over one or two superficial or deep-seated glands (generally femoral or inguinal), which may be a little enlarged, but without any exudation around them. Rest in bed, a gentle aperient and some fomentation is all that is needed for the patient's recovery, and he is generally about and able to resume work within three to four days. There is not the least doubt that a large number of such cases were to be seen in the city, especially during the early and the last months of the epidemic, but as they seldom resorted to Hospital for treatment, they did not come under observation. It is needless to add that such glandular swellings subside and totally disappear within the period named, and it is probable that this was the character of the majority of the "early" cases, so called, that gave such favourable results with Yersin's serum.

#### 2. *Pestis Ambulans.*

28. A few cases of this nature were observed, and they are interesting from the fact that the disease has a longer duration than the above, running a sort of subacute course, but is neither fatal, nor a source of very great inconvenience to the patient. The history is generally that of sudden fever of short range with enlargement, pain and tenderness of glands, the patient being confined to bed for about three to four days without much systemic disturbance. He does not feel himself sufficiently ill to consult a medical man; perhaps takes rest and shakes off the fever, and then goes about with an indolent swelling for a few days. The swelling may after a time gradually subside, but in the few cases observed in this Hospital, patients sought admission when the buboes had soften-

ed, and on incision they were found to contain pus, sloughs and the peculiar cheesy material which is so characteristic of Plague buboes. Almost the whole gland sloughs away, the patient making a tardy convalescence as in ordinary cases of Plague. Such cases are therefore characterised by (*a*) initial fever of short duration, (*b*) enlargement of glands, (*c*) absence of systemic disturbance, (*d*) a period of latency and apparent convalescence, followed by (*e*) suppuration and sloughing in a majority of cases or resolution in a few, and ultimate recovery.

### 3 & 4. *Simple Bubonic and Septic Forms of Plague.*

29. It is these two forms of Plague that are so characteristic of the disease, and the differentiation between the simple bubonic and septic forms is a question rather of degree, than of kind, depending, as it does, upon whether the Plague bacilli infect or do not infect the blood. So long as the bacilli are confined to the lymphatic system alone, without infecting the blood, the case may be called simple bubonic, but once the blood is infected and graver symptoms develop with infection of other glands, extensive infiltrations, &c., the case becomes septic. So that, in the clinical description that follows, the symptoms which are referred to may, according to their severity, be grouped together as simple bubonic or septic. The one is but a grave or more aggravated form of the other, and consequently more fatal.

### 5. *Pulmonary Form of Plague.*

30. In this form the lungs seem to be primarily infected, resulting in a peculiar form of lobular pneumonia quite characteristic of the affection. It has been assumed that the pneumonia here is a primary pneumonia as distinguished from the secondary form which appears in some cases of Plague after the buboes have become fully developed. It is further said that the infection is limited to the lungs only, and that the lymphatic system remains practically free. In some cases, however, of undoubted primary pneumonia, all efforts to discover the presence of a bubo during life failed, but on *post-mortem* examination, deep-seated axillary buboes with the characteristic swelling were found, even although the bronchial glands seemed to be quite normal. It is therefore debateable whether the axillary buboes in question were primarily or secondarily infected. This form of Plague is the most insidious and most fatal, and is also a fruitful source of spreading the infection from the sputum, which is loaded with Plague bacilli. The symptoms are just as grave, if not graver than, in the septic type; lung symptoms, of course, predominating with intense dyspnoea, cough, hemorrhagic or rusty sputum, and gradual failure of heart's action with or without coma.

### 6. *Non-Typical Forms of Plague.*

31. Just about the time that the Plague epidemic was subsiding (although the period is not comprised within this report), a number of cases were observed which had the following characteristics: slight fever, diffused swellings with more or less infiltration generally over the parotid and cervical glands, absence of glandular enlargements, or pain, and gradual subsidence from the application of cold and the internal administration of calcium chloride. Such cases came from infected houses or districts, and their general aspect, speech, state

of the pulse, together with the above symptoms, led to their being diagnosed as non-typical cases of Plague. Almost all of them recovered, indicating a gradual decline in the intensity of the virulence of the virus.

Lastly, when relapsing or famine fever made its appearance in Bombay, cases were admitted with buboes and all the symptoms of Plague, and on their subsidence, fever of a relapsing type developed—in fact cases appeared to be under a kind of dual infection of Plague and relapsing fever. In some of these cases the buboes suppurated, whilst in others they resolved. It is also probable that cases of relapsing fever with diarrhoea were thought to be cases of the abdominal type of Plague, which again was said to assume a choleraic type. Patients were often brought to the Hospital, either as Plague cases, or cases of cholera, and they were found to be cases of relapsing fever with diarrhoea in the acute stage, or else cold, and collapsed with feeble or no pulse, husky voice, and dark areola around the eyes, and diarrhoea during the stage of interval or fall in relapsing fever.

### III.—MODE OF INFECTION.

#### (a) *Through the Skin.*

32. The preponderance of buboes in the femoral and femoral-inguinal regions led to a natural inquiry as regards direct infection through the skin, but in not more than 5 per cent. of cases could direct evidence of infection through breach of surface be traced, and this is really inconsiderable when it is remembered that most of the patients admitted were in the habit of going bare-footed all their lives, and had innumerable cracks and fissures on the soles and elsewhere. Yet traces of inflammatory mischief from the absorption of the virus through the crack or fissure were conspicuous by their absence. In about half a dozen cases small pimples were observed on the dorsum of the foot, and their contents having been evacuated, strong carbolic acid, about five minims, was injected into them. The result was very striking, for within a few hours of the injection, the buboes became less painful and tender and distinctly smaller, and the patients' general condition also improved. They all recovered. But such a happy termination could not be always expected on account of the rarity of pimples or pustules indicating the mode of infection through the skin. In those cases where skin complications in the shape of blisters, boils or ulcers were present, it was not easy to determine whether they were the initial cause or the effects of the disease, but in some the history pointed to the presence of a blister or sore previous to the appearance of the buboes, thus indicating infection through the skin. This was observed, however, in a very small proportion of cases and could not by any means be made applicable to all.

#### (b) *From the Contents of Buboes.*

33. The pus from incised buboes was always found on the first day to contain a large number of Plague bacilli, which however gradually diminished within three to five days, after which the discharge from the wound was almost always sterile. It is, therefore, conceivable that the pus would be a source of infection, coming in contact with a direct breach on the surface or through dressings saturated with the same. In the case of Dr. Davda

it appears he must have received direct infection through the hands as he had operated upon some patients both at the Arthur Road and Lohana Hospitals about three or four days before his illness, and because of the fact that the buboes in his case were axillary with diffused infiltration over the chest, shoulder, arm and forearm. It was a fortunate circumstance that other members of the staff who had day after day to incise buboes, explore the wounds, dress patients, etc., escaped, and that must be attributed solely to the great care exercised in disinfecting and cleaning the hands.

(c) *Through the Sputum.*

34. The sputum in cases of pneumonia, primary or secondary, has been observed to contain almost pure cultures of Plague bacilli, and knowing, as we do, the habits of the lower classes, who would spit anywhere and everywhere, round about where they may be sitting or lying down, it is not difficult to conceive how prolific a source of infection such sputum must be, and that it must have played and is probably still playing a by-no-means insignificant part in diffusing the epidemic.

(d) *Through Inspiration.*

35. The detection of primary pneumonia led to the conclusion that there was direct infection through inspiration, and when this is considered in conjunction with what has been said in the above paragraph, it is easy to perceive how bacilli from the dried sputum could be carried about in the atmosphere and inhaled directly into the lungs. Ordinary respiration, or rather expiration of Plague patients, does not seem to infect, for, if it did, scarcely a Doctor, Nurse or Hospital Attendant would enjoy the immunity that they have hitherto done.

36. Apart from the above-mentioned modes of infection, it is but reasonable to assume that the Plague epidemic which progresses like a regular wave from one end of the country to the other, either slowly or rapidly, generally the former, infects those susceptible to such infection through the atmosphere, as in influenza and other similar affections, and that, in its rise, progress and decline, it has certain similarities with influenza, which should not be ignored, but, on the other hand, given their due weight in considering the history of the epidemic. Otherwise it would be impossible in a large number of cases to trace any distinct modes of infection, for those above-named are applicable to a few cases only; in the large majority it has not been possible to lay down the exact source of infection, and in an acute infection of this kind, pervading so insidiously and so widely, atmospheric agency must be a potent factor.

37. It is possible that the excreta of a plague patient, such as feces and urine, may be sources of infection, either directly or through soiled bedding, clothing, etc., but such cases are difficult to trace, and besides it has not been yet ascertained in what proportion of cases the excreta contain the Plague germ. Systematic and searching examination in a number of cases made by the Austrian Plague Commission failed to reveal the presence of Plague bacilli.

38. Infection through the stomach appears to be doubtful, specially in the light of the fact that hardly in any case were abdominal symptoms marked,



or the mesenteric glands so enlarged as to indicate primary infection through the digestive tract. Careful investigation besides has given no indication that would lead one to suppose infection through this channel. The vomited matter has also given negative results. No infection through the water-supply was possible, as it is extremely pure and beyond all suspicion, and as to any particular kind of grain being an infecting medium, the chances are against it, not only on account of the prolonged boiling and heat requisite to cook the grain, but also from the fact that the epidemic spread amongst all classes of people—those consuming and those not consuming the millet-grains—which for a time were supposed to be the *causa causans* of the Plague.

39. In no case was the Plague attributed to rat-bites, either immediately or sometime previous to infection. And as regards flies and fleas, ants, bugs and even mosquitoes, however enticing the theory appeared as tending to solve a difficult problem, it was more fanciful than real, appealing, as it did, more to the imagination than to reason and common sense.

40. Shoe-bites were supposed to have caused buboes, and it is but reasonable to assume that they too, like any common open sore, might have been channels of infection, but it should be at all times easy to determine the effects of a shoe-bite, and differentiate the same from Bubonic Plague.

#### IV.—INCUBATION PERIOD.

41. It is notorious that people of the classes chiefly admitted into this Hospital are inclined to be inexact in their statements of facts. Even in such a well marked disease as relapsing fever, with a definite period of rise and fall, patients have solemnly and gravely assured us, when brought to the Hospital just before or after the crisis, that it was the first day of the disease or that they had never been ill before. Hardly any reliance could, therefore, be placed upon the information supplied by them on such points, but from careful inquiry from intelligent patients, it was found that generally the period of incubation was from 3 to 6 days. In exceptional cases only was it under 3 days or over 6, although at times the period may extend to 9 to 10, or even 12 days, according to the power of resistance of the patient and his general state of health. For all practical purposes, the period of one week may be considered fairly safe for keeping suspects under observation.

#### V.—GENERAL CONDITION OF PATIENTS ON ADMISSION.

##### (a) *Attitude.*

42. The attitude of patients depended upon the stage in which they were admitted. Generally they were too far advanced to assume any characteristic position, but if recumbent they generally lay flat on the back, with the limbs extended and almost invariably one leg crossed over the other. This was so often observed and was so persistent that every time a thorough examination had to be made, the legs had to be separated apart. Otherwise the position of the body depended upon the nervous condition of the patient. In the apathetic cases, the patient would generally lie on the one or the other side, with arms and legs

flexed, the former against the chest and the latter against the abdomen, in fact, literally doubled up. If the patient could assume a sitting posture, the attitude indicated thorough prostration and helplessness, the head bent upon the chest, the arms and legs hanging listlessly.

(b) *Gait.*

43. The gait of the patient was, as a rule, tottering with weakness of the limbs and bending at the knees, indicating, as said above, thorough prostration; otherwise it varied according to the stage of the disease or the delirium.

(c) *Aspect.*

44. The aspect of the patient was almost always characteristic, although it was considerably obscured during the height of delirium. Ordinarily the Plague seemed to be stamped upon the patient's features, giving it a characteristic, and not to be easily-forgotten, appearance. The features depicted fear and anxiety or sadness and resignation, as if from an intuition of the impending fate. In fact, what is called *Facies Pestica*, so characteristic of the affection, is typified in this mixture of dread, anxiety and resignation. Apart from this, the condition of the patient, whether mildly delirious or apathetic, comatose or cyanotic, determined the aspect in advanced cases. In the height of delirium, the patient may have a wild maniacal look, with blood-shot eyes, the eye-balls rolling and protruding through their sockets, and dishevelled hair giving an extremely weird aspect, or otherwise the patient may appear gloomy with a disheartened expression, or else apathetic or perfectly vacant. In the comatose condition there is a dull or drowsy look with the eye-lids half-closed and the face more or less cyanotic, the nostrils constantly acting from dyspnoea.

(d) *Speech.*

45. The speech was, as a rule, most characteristic and, in fact, speech combined with the aspect, more often than not, determined the diagnosis of Plague, even before the patient was touched, and time after time cases were diagnosed by simply asking the patient a question or two and noting his mode of reply. The speech was of two kinds. In the one case, it resembled that of a man under the influence of drink, the words being broken up into syllables and each syllable articulated with some difficulty and hesitation and in a more or less thick and husky tone. The syllables may again be broken short. For instance, a man called Laximan would, when asked his name, reply—La—x—man. In the second variety the patient's reply would be couched in an irritable and angry tone, the words being pronounced snappishly with a very cute and angry look, with the forehead thrown into wrinkles, indicating that he was annoyed at being disturbed.

Either one or the other of the two varieties described above characterised most of the cases, but with the exception noted below.

46. This exception was the loss of the power of speech or aphasia which either appeared from the beginning, or developed in the course of the

disease. Aphasia with high fever, and the peculiar aspect of the patient, would be a strong presumption in favour of Plague, whether with or without buboes. It has been noted in a fairly large number of cases.

#### VI.—TEMPERATURE.

47. In an essentially acute febrile affection, such as the Plague, the rise of temperature attracts early attention. After a period of general *malaise* lasting a day or two, sometimes more, and coincidentally with the appearance of a bubo in some part or other of the body, the temperature commences to rise. It may or may not be preceded by a rigor, and perhaps during the first day or two, the general condition of the patient indicates nothing very serious. The temperature from the first day rises gradually, attaining the maximum on the second, third or even fourth day. When, however, the infection is very acute, or in cases of children, it may attain the maximum within 24 hours. Children always show a higher range of temperature than adults. But the range of temperature, except when it is very high, is no criterion of the severity of the case. The general range of temperature is between  $102^{\circ}$  to  $106^{\circ}$ , the highest observed being  $108^{\circ}$ . The usual range is between  $102^{\circ}$  and  $105^{\circ}$ ; whereas in some very severe and fatal cases the temperature has not been observed to rise beyond  $103^{\circ}$ . The natural course of the fever is that of morning remissions and evening exacerbations with a difference of 1 to 2 degrees. This may go on in cases which are likely to recover up to the sixth or seventh day, when the temperature begins to decline steadily, and falls gradually by graduated morning and evening rises and falls, until it reaches the normal about the 10th day. But if the bubo is suppurating, it may deviate from this course, the period being somewhat prolonged until suppuration is complete, when the temperature falls to normal. The temperature generally goes down by *lysis*,—*crisis* being exceptional. When the latter is observed and it has a fall of from  $4^{\circ}$  to  $5^{\circ}$  or  $6^{\circ}$ , it almost invariably indicates collapse and impending death. And it has been so often noted, especially during the morning rounds in the wards, as to become a well-marked indication of approaching dissolution, and, however gratifying the drop to the normal may appear on the chart, it is the last drop the unfortunate patient is destined to have, and with it he is found to be in a cold collapsed state, bathed in clammy perspiration, pulseless or with an extremely feeble pulse, and low whispering voice; he gradually sinks away in this condition in spite of all efforts at resuscitation. At times, however, the patient may be snatched from the jaws of death even at this stage and recover.

48. Sometimes it is observed that on the second, third or fourth day, the temperature comes to normal or thereabouts, rises suddenly and again falls, the case ending fatally with the second fall. In other cases the temperature may continue to rise or fall as usual, the patient dying at the temperature of  $104^{\circ}$  or upwards. In fact, intermissions are not uncommon in a Plague chart, and they generally occur in such cases as are of the septic type of Plague or likely to prove fatal. A short crisis of 2 or 3 degrees unaccompanied by collapse generally indicates completion of suppuration in the bubo, and when the charts indicate a crisis of this kind, inspection of the buboes shows distinct fluctuation. After the buboes are incised, the temperature may show a slight evening rise, but in ordinary cases,

when suppuration and sloughing are not extensive and there is no retention of pus, etc., it soon falls to normal, and continues so until complete recovery. If, however, the sloughing and suppuration be extensive or deep-seated, the temperature rises and falls day after day as in cases of septicæmia or hectic, and there is generally a difference of 2 to 4 degrees between morning and evening temperatures. As the patient improves, this becomes less and less until it reaches the normal.

49. Various causes tend to derange a normal Plague chart, and among these may be mentioned—appearance of fresh buboes in different parts of the body (which may resolve or suppurate), accumulation or retention of deep-seated pus or sloughs, secondary pneumonia, abscesses, &c. In a few cases when convalescence seems to have been well-established, malaria, rheumatism or even phthisis complicate the chart, and the characteristics of each become well defined and well delineated. The charts appended with the report illustrate the usual conditions of temperature as well as the variations brought about by the various causes indicated.

#### VII.—LYMPHATIC SYSTEM.

50. The appearance of a bubo with a rise of temperature is early noticed, and if it is tender and painful, the patient complains more about it, than about his general state. The bubo may appear *before, with* or *after* the rise of temperature, but, as a rule, its appearance is coincident with it. It is exceptional to notice its appearance either before or after the rise of temperature, and only a very few cases have been observed. In one case which was of an exceptionally severe type, and which proved eventually fatal, the bubo—a femoral—appeared on the sixth day after admission. The patient was admitted with high fever and very violent delirium; the least touch used to excite him and make him dangerous to those about him, so that it was not at all easy either to keep him quiet or administer medicines, etc. The high temperature and delirium continued for about five days, when the temperature fell, causing great prostration and, coincidentally with this, the bubo appeared. The patient eventually died from gradual failure of the heart's action.

51. The appearance of buboes is characterised by pain, tenderness and swelling. Pain may be said to be rarely absent, and sometimes the parts are so extremely sensitive, that it begins to be felt long before the bubo becomes evident, and sometimes pain is felt when the buboes are so deep-seated that they can scarcely be felt. But strange to say, in some exceptional cases, not only pain but even tenderness was absent, and the buboes could be freely handled without causing discomfort to the patient. The character of the pain also varied from being simply dull and aching to sharp and lancinating. And, moreover, the size of the bubo had no direct connection with the amount of pain or tenderness. The degree of pain is greatly influenced by the tension in the bubo and by the infiltration round about it. Sometimes, large mobile masses can be freely handled, whereas, in other cases, a small bubo may be extremely sensitive. In some cases buboes enlarged to not more than the size of a pea were found so excruciatingly painful and tender that the least touch produced the greatest agony.

52. Tenderness was, as above said, often most marked, so much so that patients in a half comatose or dull apathetic state would suddenly start up on being handled, but, on the other hand, it was often absent as in the case of pain.

53. Swelling was always well marked, whether the buboes were deep-seated or superficial, and even in cases of the former in the axilla or neck, careful examination generally indicated some amount of swelling. The swelling is due to two causes, *firstly*, to inflammation of the gland, and, *secondly*, to effusion or infiltration, serous, sero-sanguineous or hæmorrhagic, around the buboes and the surrounding structures. It varied in extent and intensity in various cases. In the femoral and femoro-inguinal regions it was generally confined to the upper half or two-thirds of the thigh, and in that position it did not generally extend rapidly or involve vital parts. But in the case of the axilla and neck, it always was of very grave import. For instance, in cases of axillary buboes or pectoral, *i.e.*, those situated beneath the pectoralis major, a certain amount of exudation around the axilla and over the pectoral muscles may be observed the first day. But within a day or two, sometimes within a few hours, it may become so extensive as to involve the whole of that side of the chest up to the scapular region and even beyond it up to the vertebral column; it may also extend to the shoulder, arm and forearm, and even above the clavicle. This, of course, is always accompanied by intense pain, tenderness and swelling, at last terminating fatally. Or, again, if the exudation be confined to one side of the neck, it would extend to and involve both the sides, the face, even spreading far up to the cranium over the occipital, parietal and temporal regions. It naturally pressed upon the most vital structures and, except in very rare cases, ended fatally. The exudation on the chest and the upper extremity was generally more of a sero-sanguineous character as against hæmorrhagic in cervical cases. If the patient's life is prolonged after this, the infiltration becomes hard and almost stony, neither pitting on pressure, nor bleeding freely when incised. Incisions, to relieve tension and pressure upon vital parts in neck cases, almost always failed to give relief, for there was no free oozing of blood even when it was encouraged by warmth or pressure, and such cases always proved fatal. The amount of exudation and its organization varied, but the incisions made on one day could hardly be seen on the next, and most of such cases survived a very short time after admission. Only rarely did recovery take place, and then it was by prolonged and by deep-seated suppuration and sloughing, rarely by resolution. Occasionally an erysipelatous blush supervened on such exudations, with a consequent fatal termination.

54. That such exudations exerted an unfavourable influence on the course of the affection was undoubted, and time after time was it noticed that cases with exudations were more fatal than those without them. Axillary and cervical buboes, if superficial and unaccompanied by exudation, generally recovered, whereas those with exudations succumbed, and, as said above, the rapidity with which the exudation extended was a fair criterion of the gravity of the case. The more rapid and extensive the exudation, the sooner and greater the mortality, and the sudden appearance of exudation on the second or third day was almost always a bad prognostic.

55. The size of the bubo was quite independent of the gravity of the case, and instances have not been infrequent where small glands from the size of a



58. It thus appears that the femoral buboes preponderated, and calculating the percentage of each class to the total, the following gives a fair estimate of the position of buboes :—

Femoral	...	...	...	...	...	...	...	32·12 per cent.
Femoro-inguinal	...	...	...	...	...	...	...	23·36 „
Axillary	...	...	...	...	...	...	...	16·85 „
Inguinal	...	...	...	...	...	...	...	12·38 „
Cervical	...	...	...	...	...	...	...	5·25 „
Multiple	...	...	...	...	...	...	...	4·67 „
<hr/>								
Total	...	...	...	...	...	...	...	94·13 per cent.

The above six principal positions account for 94·13 per cent. of the buboes that came under observation.

59. Besides the buboes, the lymphatic system shows other evidences of infection. Inflammation of the superficial as well as the deep lymphatic vessels, especially in the lower extremity, often occurs. This lymphangitis is generally descending, but sometimes ascending, the latter occurring in such cases as show any distinct points of infection. The former shows itself some days after the appearance of buboes, and not infrequently the whole of the thigh and leg appear greatly swollen and angry-looking. This may or may not be accompanied by enlargement of other deep-seated lymphatic glands; in some instances deep sloughing has been noticed in the popliteal space and between the muscles of the calf. The same also occurs in the upper extremity but not so frequently. In fact extension of mischief and a serious condition of the infection make themselves evident by the onset of lymphangitis in the lower extremity, and by serious or sero-sanguineous infiltration in the upper.

60. If the buboes in the acute stage be incised, they present a characteristic appearance. Hæmorrhage is free on incision, and, on section, the gland appears as a large swollen mass of an intensely brownish-red, brick-red or purplish colour, and occasionally a thick black streak has been observed running right through it. The knife while incising grates against the capsule, and the same is often felt in making a section of a bubo during life.

61. Once the buboes have appeared, they take one of two courses. They either resolve or end in suppuration or suppuration and sloughing. Sometimes, however, large masses remain indolent for a period varying from 4 to 8 or even 12 weeks, and then suppuration sets in, entailing a great amount of annoyance and distress to the patient who believed himself to be cured of the affection. If resolution is to take place, it is observed that it does so very rapidly and once the temperature has fallen to normal, from a week to a fortnight is the period within which all traces of the bubo disappear. If such is not the case, it remains in an indolent condition for a long time before it eventually suppurates.

62. Suppuration is, however, the most frequent termination of the buboes and this may or may not be accompanied by sloughing. Suppuration as well as sloughing do not take place equally in the same bubo or in a set of

buboes, and very often if a case survives long enough after general infection of the system, buboes after buboes develop, enlarge, suppurate and slough in various parts of the body, sapping the patient's strength and carrying him off in the end from exhaustion from the extensive drain on the system. Instances have been noted where buboes in the axilla, in the neck, in the femoral and inguinal regions have been discharging, at one and the same time, large masses of sloughs and a not inconsiderable quantity of pus day after day. Or again in deep-seated pelvic suppuration or in that between the muscles of the thigh and calf, the patient may discharge daily from a pint to pint-and-a-half of pus. In those cases where a large single gland is observed, hardly any fluctuation may be felt and the gland may appear indolent, and even, when incised, it may not show any traces of suppuration, but on deep pressure pus and slough appear and, if the incision is enlarged, the entire bubo may be found in a sloughy condition.

63. The extent of the sloughing varies a great deal; it may be confined to a single bubo only or to a group of buboes situated on the same part or on different parts of the body at one and the same time. Or it may involve the skin and the connective tissue over the area of infiltration around the bubo, or again penetrate deep between the sheaths of muscles exposing the same. The muscles in the Scarpa's triangle may be laid perfectly bare as if carefully dissected, and the same may happen to the muscles of the abdominal wall, of the floor of the pelvis, of the popliteal space, of the axilla, and even of the neck. If the deep iliac buboes in the pelvis suppurate and slough, communication may be established between the psoas muscles extending right down into the thigh. Pus and sloughs may also burrow between the muscles of the abdomen, communicating from one side to the other and extending even into the scrotum. In the case of females, adult as well as children, the sloughing may extend into the *labia majora*. In fact, there is no limit to the extent to which sloughing may go, especially in weak and debilitated subjects and in such others as have freely used the marking-nut as a counter irritant.

64. The character of the contents of the buboes also varies; the pus may be quite limpid, sweet and healthy or it may be coagulated in small cheesy masses, or again there may be a kind of acrid foul-smelling sero-pus. At other times, the pus may be mixed with a large quantity of blood or it may be entirely replaced by large dark jelly-like masses of coagulated and disorganised blood, with a large quantity of sero-sanguineous fluid.

65. Once the bubo is incised and the slough and pus removed, for which a fairly large and free incision is necessary, the remaining shreds gradually separate and a healthy granulating cavity is left, which heals very very slowly, so that convalescence is greatly protracted and the patient is not fit to be discharged for a considerable time after the first incision. In other cases, deep sloughing or suppuration appear after the primary buboes have been incised, or other buboes in the neighbourhood may be infected, thus preventing the healing of the primary wound and retarding convalescence. This is specially observed in the cases of femoral and femora-inguinal buboes. A few days after the bubo is incised and the temperature has fallen to normal, the patient entering into a period of apparent



convalescence, suddenly the temperature rises to 102°, 103°, or 104°, the patient complains of pain in the pelvis above the Poupart's ligament and on examination a large mass varying in size from an egg to an orange is seen welling out of the pelvis. It may increase in size still further, or remain quiescent, and may gradually subside under appropriate treatment, within a week, the temperature falling with its shrinkage until it reaches the normal, the patient making a complete recovery. This is its usual course. But occasionally this large mass suppurates and establishes a communication with the lower wound, and gradually goes down in size until all discharge from it ceases. At other times, fluctuation may be felt over its site, and then an incision might be made, and the pus evacuated. Or again it may burrow in the pelvis or between the psoas muscles, forming a huge purulent sack extending deep into the pelvis and to the middle or lower third of the thigh. The latter contingency is always to be dreaded as it leads to prolonged suppuration and eventual marasmus and death. Another danger that confronts one in dealing with such deep-seated suppuration and sloughing is erosion and ulceration of the coats of blood vessels. The iliac artery or the iliac vein may be the seat of such erosion and may easily be punctured without any force, as in the act of introducing a drainage tube. In one case the iliac vein thus gave way and hæmorrhage was very difficult to control, but it was successfully done with a graduated compress.

66. Having tided over all such mishaps, the patient may be on the high road to recovery, but the wound heals very very slowly, especially in cases where there is extensive sloughing; day after day the wound or ulcer remains in exactly the same condition. The granulations are there, but they are flabby and unhealthy. What is seen is nothing but a raw-looking surface, devoid of much vitality and quite unlike an ordinary healthy granulating surface. When the healing is complete, there is a risk of small sinuses being left, which may afterwards give rise to trouble, but which can be avoided by a little timely intervention. And lastly, once the wound has thoroughly healed, the cicatrix in many instances exhibits a peculiar appearance. It may be puckered up or thrown into folds round a central depression with deep furrows in between or else it may appear exactly like a keloid in no way differing from a burn cicatrix.

#### VIII.—NERVOUS SYSTEM.

67. It is apparent at a very early stage of the disease that the nervous system is profoundly affected, and the *Facies Pestica*, full of anxiety, fear or dread, combined with the characteristic speech, indicate the same. Head-ache, vertigo, intense pain at the back of the head, over the frontal region, along the spine or in the course of the great sciatic nerve, muscular twitchings, tremors, and subsultus appear as the case advances. The normal reflexes become dull, if not altogether irresponsive, and the normal stimuli that always bring them into action fail to rouse in them any response. These again may be followed by still graver symptoms.

68. If the patient is seen on the third or fourth day, when the symptoms are at their height, he may be found either comatose or delirious, the coma and delirium varying in degree, and if the meninges be affected, signs of meningeal

irritation are observed with or without spasms and, in some cases, convulsive seizures are not uncommon at a late stage of the disease. The coma may vary in intensity from a deep somnolent condition from which the patient can be roused with some effort, to an extremely deep unconscious condition in which the patient is perfectly unconscious and oblivious to his environments, with stertorous breathing and intense dyspnoea. Such cases are almost always fatal and beyond all hope when brought to the Hospital. A large number of them were brought to the Hospital in this condition, and the greater portion of the mortality within the first 24 hours is attributable to them.

69. Delirium, if present, may be acute and active or low muttering as in the typhous condition. The acute form varies in intensity. In some cases the patient confines himself to frequent attempts to get out of bed, in others he becomes maniacal, with violent suicidal or homicidal tendencies. The various phases in which it showed itself were extremely interesting. In one instance of maniacal delirium, a woman with a child would have dashed out the brains of her child, but for the timely intervention of the attendants. Often patients got out of bed and tried to run out of the wards, and sometimes a patient would even jump over the compound wall—which was low—if not constantly watched. In some instances patients in this condition ran to their homes and were brought back. Others would fall out of bed time after time, and that too in a very peculiar way. The patient might appear to be lying quietly when all of a sudden he would seem to be lifted bodily out of the bed, as if from an unseen force from below, and then describing a semicircular movement would fall violently on the ground. At other times, he would simply roll out of the bed on one side or the other without attracting any attention. Some patients used to show a peculiar fondness for a particular bed, either that of a neighbour or of some patient at a distance, and would get out of their own bed and try to lie down beside the other patient, doing so quietly, or in the act falling heavily on the occupant. And this might be repeated time after time unless there was a constant watch or they were tied down in bed. Another patient would fancy no better position than lying underneath somebody else's bed, either in the close neighbourhood or at a distance, and often, after searching in vain high and low, he might be found thus safely and quietly ensconced; and this, too, might be repeated over and over again. Or, again, another would get out of bed, crawl along the ground, dragging behind him his bed, just as a child does a toy-cart, and peregrinate the wards in this fashion. In one instance a strong powerful-built man ran up one of the iron columns, supporting the roof, and then rested himself astride on one of the trusses, and was only brought down with great difficulty. At other times patients would try and climb over the partitions separating the wards, or, crawling flat upon the floor, try to escape out of the wards by the small ventilating spaces below.

70. Then, again, time after time bed clothes would be thrown aside, the patient lying stark naked and exposed. He might lie lengthwise flat on the bed or crosswise, with the legs resting on the ground, or else he might be half-way down the bed with the head about its middle and the feet at the foot of the bed resting on the floor. And these positions were repeated as soon as corrected,

so that it was extremely difficult to keep the beds at any time approaching to tidiness. Added to this, very often there were involuntary evacuations and urination, so that the bed-clothes were constantly soiled and had to be frequently changed. Very often peculiar attitudes or movements of the limbs were a noticeable feature in this state of delirium. For instance, some of the Christian patients would always be found in the attitude of prayer. They would be found in the kneeling posture in the centre of the bed, with clasped hands and uplifted face. And as often as they were put in the right position, they would revert to it. Or, again, in their delusions people following particular trades would show by their movements in delirium that they were under the delusion that they were plying the same. At other times peculiar purposeless muscular movements, neither spasmodic nor convulsive, would be observed; patients moving their limbs about, sometimes wildly, sometimes rhythmically. In one instance, there were peculiar rhythmic movements of the legs, arms, eyelids and lips, alternately closing and opening the two latter, and at the same time flexing and extending the limbs; in others the movements were not so general or rhythmic, and were occasionally accompanied with laughter. The patient's laughing may be but a simple grin, ordinary laughter or most hilarious merriment, weirdly unnatural and out of keeping both with the gravity of the case and the surroundings of the patients. Some of these cases were not so intensely delirious as not to be conscious of what was passing around them, and yet they have sunk within twenty-four hours.

71. At other times the patients were so hyper-sensitive that they would brook not the slightest interference with their person. The slightest touch would send them off into peals of screams, which not only pervaded the whole hospital, but even attracted the notice of passers-by on the road. Feeding, administering medicines or making their beds was extremely difficult and even dangerous, as the patient would scratch or even bite the attendants or nurses, and squirt out the contents of his mouth on the body of the person nearest. In one instance, a ward boy was bitten severely on the thigh by a patient in this condition; but, luckily, nothing happened to him. Some patients would incessantly talk, talk and talk day and night, without the slightest intermission, disturbing the other patients and distracting the attention of the nurses and ward attendants. Obscene language, foul swearing, abuse, and even indecent gestures were not absent at times in this acute delirium.

72. Hallucinations were not uncommon, and the patients imagined they saw relatives and friends when none were present. Such hallucinations varied with perhaps what was uppermost in the patient's mind during his healthy condition, and in one sad case a man was trying to get out of his bed in a very angry and excited manner, saying, at the same time, that he was about to kill a man who he believed he saw having illicit intercourse with his wife.

73. Low, muttering delirium may also be present at times, but not so often as the acute. The patient may be lying in a semi-prostrate condition picking at the bed clothes or at imaginary objects, and muttering in a low, husky voice.

74. Convulsive movements appear at a later stage of the affection, especially if the meninges be involved, or if there be increased brain-pressure from an

excess of fluid in the arachnoid cavity. They may be one-sided or double, confined either to one or the other extremity. When these seizures come on, the head may be twisted on one side or the other, the eyeballs prominent and rolling with convergent or divergent strabismus, often the former. And at times they may assume a still graver character. In about half-a-dozen cases it was noticed that these convulsive seizures were periodical, with intermissions of shorter or longer duration, and partaking of a tetanic character. In fact, were it not for the presence of other indications of the Plague, it would not have been easy to diagnose them as such. In most of them, the tetanic character was perfect and opisthotonos, well marked and accompanied by sardonic grin and loud laughter. Some patients had very strong spasms of the respiratory and abdominal muscles, practically stopping respiration for a time; and in these cases life was saved more than once by the immediate and timely use of nitro-glycerine or nitrite of amyl. Eventually, however, all such cases proved fatal.

75. In some of the graver cases, where delirium and convulsions were absent, another peculiar condition, which may not inaptly be called apathetic, mechanical or vegetative, was observed. In this state, the patient lies quietly in bed, is conscious or can be easily roused, is quiet and takes his food and medicines in a semi-conscious condition. This condition is not apparent from the very first, except in a few cases; generally, it sets in quite suddenly, when the patient is entering into a convalescent condition. The natural termination is either improvement and gradual recovery or death. If the former, the improvement is extremely slow, and may take weeks; and eventually, though the physical recovery may be perfect, the mind remains enfeebled, and a condition of imbecility supervenes, and in some cases total loss of mental powers and insanity. Aphasia, which is a well-marked and often present complication in this stage, may also get better. In fact, some patients after total aphasia and temporary mental aberration have left the hospital completely cured, both in mind and body, without any aphasic signs. If the case takes an unfavourable turn, the patient gets feebler and feebler, is bundled up in bed, extremely peevish, whines or cries when disturbed; gradually it becomes extremely difficult to feed him or administer medicines, and he sinks into a marasmatic condition until death supervenes, the patient dying a complete physical and mental wreck. The condition of the patient in this stage is extremely pitiable; he becomes wasted to a mere skeleton and looks more like a corpse than a living being. The extremities are cold, pulse extremely feeble, eyes half or wholly closed, respiration shallow; there are sordes on the gums and teeth, the saliva lodges between the lips, and at each expiratory effort a little trickles down the angles of the mouth; mucus and bronchial secretion are visible at the orifices of the nose, and may be similarly discharged at each expiration. All the normal reflexes being dulled, the patient is speechless, and takes very little nourishment, or has to be supported on nutrient enemata. Even from this condition recovery is occasionally possible, and has occurred in about half-a-dozen cases.

76. Aphasia has been referred to above as a concomitant of the apathetic state, and the way in which it shows itself is extremely peculiar; it may come on during convalescence, or else the power of speech may be completely

lost in the acute stage. In a day or two, the patient becomes completely aphasic, which is very striking, especially when the patient has been heard speaking distinctly only a day or two before. For a few days it remains more or less stationary, and then improvement begins, the patient making a few inarticulate sounds and gradually recovering power. The speech during recovery resembles that of an infant learning to speak, and although power may be completely regained, some defect may last for months, the speech remaining thick and faltering.

#### IX.—CIRCULATORY SYSTEM.

77. In no other acute infectious disease does the pulse—an index of circulation—present so many variations in force, frequency, volume and tone as in Bubonic Plague, and in no other disease is the disproportion in the normal ratio between the pulse, temperature and respiration so divergent. The character of the pulse, apart from its frequency, varies with the course of the disease. The full and bounding pulse which is so often associated with high temperatures is conspicuous by its absence, and in the majority of cases the pulse is easily compressible, extremely feeble and very frequent. The feebleness of the circulation is well demonstrated by the feebleness of the pulse, so much so that in some cases with temperatures of  $103^{\circ}$ ,  $104^{\circ}$  or  $105^{\circ}$  the extremities may be not only cold, but almost icy-cold, and bathed in cold clammy perspiration. This was, indeed, very characteristic and was often noticed. Another index of the weakened heart's action was the pulse itself which could not be felt or counted at the wrist, and heart beats had to be often counted instead. As the case advances, the pulse becomes intermittent, regularly or irregularly, more often the latter, and distinctly dicrotic. The dicrotism in some cases is extremely well marked, and in advanced cases may really be considered a reliable diagnostic sign. There is always a change for the better in this stage of circulation if the patient is going to recover, but, if otherwise, the state of the circulation becomes still graver, as shown by yet another variation in the condition of the pulse. It becomes of a beaded character—in fact, a regular water hammer pulse of aortic insufficiency—and it is not difficult to conceive what is thereby indicated. A step further, and the inevitable must happen—failure of the heart's action. And this may be gradual or sudden. In a large number of cases the failure is gradual, the beaded pulse becomes quite imperceptible, the body-temperature is scarcely maintained, the circulation getting more and more feeble and eventually collapse with fall of temperature, and death result. In these cases much could be done to support the circulation and stimulate the heart's action, and it may even be possible in a few cases to avert failure and death. But no such hope can be entertained where the failure is so sudden—so surprisingly sudden, as even to raise a doubt as to whether the patient is actually dead or not. A patient tries to sit up in bed, or gets out of it, or makes some sudden exertion, and falls down either on the bed or on the floor, and is found beyond all hope. Several such cases were observed, and nothing could be done to stop the end. No cases of sudden heart failure during convalescence have been observed, but that may be due to the strict discipline exacted from the patients, as they were never allowed to leave the bed for a considerable period, or till their wounds had completely healed. The heart-sounds have always been

found to be clear, in some cases the first sound may be weak and the second slightly accentuated, and no *bruits* or murmurs were audible. Pain on the precordial region and occasionally palpitation may be complained of, but practically the patients had very few complaints about the circulation.

78. The blood when examined was found not to be markedly deprived of its hæmoglobin, which was generally from 65 to 80 per cent., and hence not much diminished. Nothing like black blood was observable, and when the finger-tips were punctured, all that could be noticed was that the blood did not flow so easily on account of the sluggishness of circulation, but dark congealed masses of coagulated blood were discharged from the incised buboes. Leucocytosis was always present, the number of leucocytes per micro-millimetre varying from 12,000 to 28,000—the largest number found in any one case.

79. Bacteriological examination of blood was systematically undertaken by the Austrian Commission, and they came to the same conclusion as the other Commissions, that cover-glass preparations of stained blood were not only unreliable but extremely fallacious, if not actually mischievous, and that the only reliable test of the presence or absence of the Plague bacilli in the blood was by means of cultures. In fact they relied entirely upon the latter, and in their investigations no case was charred as indicating Plague bacilli in the blood, until the cultures had grown and placed everything beyond a shadow of doubt. It was observed that in many undoubted cases of Plague, no Plague bacilli could be detected or grown from the blood, and it appeared as if in such cases they were confined to the lymphatic system alone, for most of such cases eventually recovered. In fact the absence of the bacilli in the blood was looked upon as a favourable prognostic. Often, it was observed, that the day on which the bacilli were first observed in the blood coincided with the case becoming grave, and if the daily examination showed multiplication in their numbers, it always indicated a fatal termination. If the bacilli were found on one day, the next day they seemed enormously multiplied, and on the third they would be in a very large number. This would coincide with the fatal termination of the case. In a few cases it was noticed that the bacilli diminished in number the next day, and became still further reduced on the third day, indicating a favourable termination. The above is but a summary of their results, so far as they were worked out in Bombay, and further and fuller details must be awaited until their report is published. In all the observations in the blood, the Austrian Commission took extremely minute precautions to avoid all sources of contamination or error, and the cultures were made day after day and the results checked so as to leave scarcely a loophole for mistakes to creep in.

#### X.—RESPIRATORY SYSTEM.

80. Increased frequency of respiration is one of the symptoms that attracts early notice in Plague, and in which, besides the lungs, the larynx also becomes involved. It is generally highly congested, and the lining membrane often swollen, and inflamed. Edema of the glottis is frequent in cases of deep cervical buboes with infiltration into the cellular tissue, and extending into the larynx. Sometimes serous effusion is seen in the aryteno-epiglottidean fold which also becomes consequently injected and swollen. The vocal cords are generally unaffected. In

some instances the pseudo-diphtheritic membrane covering the tonsils and pharynx extends towards the larynx, and occasionally spreads lower down into it. But before this could take place, the patient generally succumbed.

81. The lungs become markedly involved. Hypostatic congestion must be expected from the position of the patient, and it varies in its extent and severity with the length of time the patient has been in one particular position. If the patient be examined early in the morning when he may have been for a number of hours lying on one side, it may be noted, and at times even mistaken, for pneumonia. If the patient be examined again after a few hours, the opposite side may be found in a similar condition, and the other clear. In fact the congestion depends upon the position of the patient and appears and disappears with the change of posture. Pneumonia is often suspected in such cases when a *post-mortem* examination reveals nothing beyond congestion and œdema.

82. Hypostatic congestion leads to œdema of the lungs and the intense dyspnoea, which is so extremely harrassing to the patient, is more often than not due to this state of the lungs. The œdema sometimes supervenes and increases with very great rapidity, so much so that patients may be carried away within a few hours. As a rule, however, its progress is gradual.

83. Pneumonia may be primary or secondary as already noted elsewhere. The expectoration is blood-stained and scanty; in some cases very profuse when the sputum is more like bloody serum and thin. Hæmoptysis has been observed in one or two cases only. But what distresses the patient most is the intense dyspnoea from œdema of the lungs. In those cases where the lungs are not involved, it arises from sluggish circulation and defective oxygenation of the blood. It is so intense as to prevent sleep, and deglutition and the act of swallowing bring on choking and increase the distress. In fact the lung complication which in the majority of cases contributes to the fatality is œdema of the lungs, pneumonia especially secondary being responsible for a comparatively small number of deaths.

#### XI.—DIGESTIVE SYSTEM.

84. The lips, teeth and gums are generally covered with sordes, and the mouth is dry, salivation being scanty and the patient complaining of intense thirst.

85. The tongue is dry, covered with a thick white fur in the centre, the tip and edges being red. After a time the fur becomes yellowish-brown or brownish-black or even almost black. Often it appears of a rusty-brown colour as if a thick coat of rust had been pasted over it. It is not easily protruded and may become fissured. In some cases it becomes inflamed. There is a regular acute glossitis, specially associated with the involvement of the pharynx.

86. The fauces and pharynx are red and injected, and the tonsils become swollen. Small abscesses are at times noticed in the latter and plague bacilli have been observed in them. A pseudo-diphtheritic membrane is occasionally seen to cover the pharynx and tonsils, sometimes extending to the larynx, and

such cases are always grave. The presence of the bacilli in the tonsils indicates a possible channel of plague infection through them, and it is likely that in some of the cases of grave deep-seated infection of the cervical glands, infection may have taken place through this channel.

87. Vomiting of a bilious character was often present, coming on after the administration of calomel and soon subsiding, but occasionally it was persistent and not easily controllable. In two or three cases the vomited matters appeared to be of a grumous character like altered blood, but in no case was any hæmatemesis observed.

88. Hiccough was a very distressing symptom, both with and without meningeal complications. Wherever it appeared, it was very persistent and intractable, yielding to remedial measures for a time and again reappearing, and so going on from one to three weeks.

89. Constipation was the rule, although in some cases diarrhœa was noticeable. It is said that early diarrhœa is a favourable sign indicating elimination of the poison, but it is a question whether it is really so. Diarrhœa also appears before dissolution, and coming on suddenly and with great frequency it indicates a speedy fatal termination of the case. Unless the patient is unconscious or in the apathetic state, he insists on getting out of bed for natural purposes, otherwise the motions are passed unconsciously and involuntarily in the bed. The motions are, as a rule, loose, sometimes fœtid. They have, however, a peculiar sickening, sweetish odour which is very characteristic.

90. Malæna was observed in three cases only.

91. The liver and spleen do not call for any particular remarks and patients do not complain about them. In one case of what is called black plague—plague with necrotic skin lesions—ascites was observed and about two litres of sero-sanguineous fluid was withdrawn by tapping.

92. Occasionally pain is complained of in the abdomen and pelvis, but in no case were the mesenteric glands so enlarged as to become evident or cause pain. Pain may be complained of in the pelvis on account of deep-seated iliac buboes and even of subacute peritonitis of septic origin.

## XII.—GENITO-URINARY SYSTEM.

93. The urine is generally scanty and high-coloured, serum albumen is always present, varying in proportion to the extent to which the kidneys may be involved. The chlorides are diminished, and daily examination showed that, with gradual amelioration in the condition of the patient, they increased in quantity. Under the microscope hyaline casts and epithelial debris are seen, but frequent examination failed to reveal plague bacilli.

94. Hæmaturia was noticed in only half-a-dozen cases. Retention of urine was a frequent complication in male as well as in female patients, and the catheter had to be resorted to. In some cases unconscious urination was observed.

Priapism was occasionally noted in some cases of plague.



95. In females, uterine hæmorrhage, menorrhagia and metrorrhagia were noticed and those cases in which pregnancy was present, generally resulted in abortion and a fatal termination. In one case only did a patient survive after abortion, making eventually a good recovery. In one case fatal uterine hæmorrhage came on in a woman that had passed the menopause.

96. Mammary inflammation with abscess and sloughing was not uncommon amongst females involving a long and protracted convalescence.

### XIII.—CUTANEOUS AND CELLULO-CUTANEOUS SYSTEM.

97. The cutaneous manifestations of the plague were many and various and may be noted as :—

- (a) *Ordinary blebs or blisters.*
- (b) *Blebs or blisters with hæmorrhage or acrid serous pus.*
- (c) *Dark depressed blisters, ordinarily called black boils.*
- (d) *Localized cutaneo-cellular necrosis.*
- (e) *Gangrene.*
- (f) *Abscesses.*

#### (a) *Ordinary Blebs or Blisters.*

98. These with serous contents were observed in a few cases at an early stage. The blister comes on generally without any appreciable cause or after perhaps slight friction, the limb becoming somewhat hot. If punctured, the contents are perfectly serous like those of any ordinary blister, but the cuticle appears of a dark-brownish colour. The surrounding skin may have a threatening darkish look and if not properly attended to, the limb may become gangrenous.

#### (b) *Blisters with Hæmorrhagic Acrid Serous Pus.*

99. These were observed in some advanced cases, the blisters covering almost the whole body, but more especially the limbs and running together into large shapeless bags. The contents were generally made up of unhealthy pus or a mixture of it with blood.

#### (c) *Dark Depressed Blisters.*

100. The so-called "black boils" were observed in a large number of cases, and they seem to bear a distinct causative relation to the buboes in their neighbourhood. They differed from ordinary boils in that no inflammatory areola surrounded them. They consisted essentially of a blister in which the cuticle had become raised sharply and evenly from the skin, without any redness or signs of inflammation. In fact it appeared as if a glass circle had been fixed over the skin and its top tied with transparent tissue paper. The top was centrally depressed or umbilicated, and from this there descended to the bottom a central slough, reaching down to the skin. The space around the slough was filled with pus or sero-sanguineous fluid. When the cuticle was removed and the central core or slough separated from the base, there remained a punched-out unhealthy looking ulcer which was difficult to heal, and took a long time to granulate. If seen early, the cuticle of these blebs used to appear normal,

but if the case had been neglected or was old and the fluid contents had become pressed out or punctured, the central core with cuticle were seen to lie directly against the ulcer, and had a dark or almost black colour. They were situated either on the limbs or trunk and in the close neighbourhood of or in direct communication with the lymphatics of the nearest buboes affected, and enquiries often elicited the fact that the first signs of the plague was this skin manifestation followed by a bubo. These boils appeared to be raised above the skin-level to the extent of half to one inch, varying in diameter also to the same extent.

(d). *Localized Cellulo-cutaneous Necrosis.*

101. This was a peculiar manifestation of plague and was most characteristic. It is probable that the older writers had observed it also, but misnamed it a carbuncle, from which it differs very greatly. It generally begins as a blister with a black slough, and then undergoes some peculiar changes which make it assume the necrotic character. It appears as a dark greenish leathery scab-like patch, varying in diameter from one to 8 inches or more and surrounded by an angry, red, swollen and inflamed areola of skin, which is covered with fine vesicles and which seems to merge into the scab without a distinct separating line. This scab-like necrosis is generally depressed towards the centre and rises gradually in level towards the periphery and appears as if tightly bound down from underneath. It increases gradually in size from the circumference, the increase being uniform all round, and the glands in the neighbourhood appear distinctly enlarged. If its progress is not checked or controlled, it goes on enlarging day after day, but fortunately in almost all cases it was possible to control its spread, and the treatment that proved so successful was a subcutaneous injection of corrosive sublimate varying in dose from  $\frac{1}{15}$ th to  $\frac{1}{10}$ th or  $\frac{1}{5}$ th of a grain. The immediate effects were striking. Its further progress became stopped within 24 hours of the injection. It was noted that the red angry areola with the vesicles looked less angry than on the day previous, and a line of demarcation formed between it and the necrosed tissue. After a day or two, it was possible to cut all round the edges and separate the slough partly, but it was not possible to remove the whole of it at once. In two or three days the whole slough could be removed *en masse*, leaving a large unhealthy, foul-smelling saucer-like depression in the subcutaneous cellular tissue. The scab thus removed varied in thickness at the centre from half-an-inch to two inches and-a-half, becoming thinner and thinner towards the circumference. Its upper surface was found to be always tough and leathery, and in fact was harder than leather to cut; the under surface was covered with dark, decomposed sloughs, pus and blood. The saucer-like depression left after the removal showed sloughs here and there, and bled profusely. Hot iodine pads, firmly tied, controlled the hæmorrhage easily, and when the dressings were removed after 24 hours, a marvellous change was noticeable. The surface appeared very clean, with healthy granulations and after the removal of shreds of sloughy tissue here and there, there remained a perfectly clean, healthy large granulating surface, which generally healed more rapidly than the incisions in the buboes: eventually the whole of it became covered up with good healthy skin. The positions in which these necrotic sloughs were noticed were most frequently the loins, the back, the interscapular region or the suprascapular regions, gluteal region, over the knee-joint and over Scarpa's triangle.

*(e) Gangrene.*

102. Gangrene was observed in about half-a-dozen cases, but in half of them the patients were practically moribund when brought to the hospital. Amongst the rest, it developed some time after admission. In one case the starting point was a blister on the foot, in another an ulcer on the foot, and in the third case a depressed blister or boil about the base of the right thumb. In all of them, the limbs became suddenly gangrenous, the skin being of a dark greenish colour and icy cold, becoming covered over with large blebs containing ichorous pus within a few hours. The temperature also rose at the same time, and two of the three cases appeared extremely grave. In one of them the gangrene had extended right up to the knee, but the timely subcutaneous injection of corrosive sublimate checked its further progress, the temperature fell, but while the part was very gradually assuming a normal appearance, the patient succumbed from another complication. In the other case, the gangrene spread right above the elbow joint, and here too the subcutaneous injection of corrosive sublimate proved effectual. The patient eventually made a good recovery, the limb resuming its normal appearance and power. In the third case also recovery took place.

*(f) Abscesses.*

103. Abscesses came on various parts of the body in septic cases, wearing away the patient's strength from exhaustion and constant drain. They proved very troublesome to heal.

104. Besides the above described cutaneous manifestations, traumatic sloughing was observed as a result of the free and extensive use of the marking nut (*Semicarpus Anacardium*, Nat. Ord. *Anacardiaceæ*) as a counter irritant. No petechiæ were observed, although very carefully looked for, except in one case when they appeared just before death, about the size of a pea, covering the greater part of the body.

Perspiration was, as a rule, not very marked, unless during sudden collapse or during a crisis from some other cause. There always used to be about the patient a peculiar smell, the smell of the plague, which it is not possible to describe, but is nevertheless characteristic.

## XIV.—THE EYES.

105. The eyes are always injected and suffused, and in many cases subconjunctival hæmorrhage is very distinctly marked, the whole of the eye appearing as a large bloody mass overlapping the sclero-corneal junction, but leaving the cornea free. When the epidemic was at its height, a peculiar form of destructive inflammation was noticed, and a large number of cases suffered from what appeared to be panophthalmitis, accompanied by ulceration of cornea, hypopion, perforation and prolapse of the iris, leading to total destruction of eyesight. Several cases were admitted almost blind, and in others the inflammation made its appearance after admission. It was characterised by its extreme rapidity, so much so that, within 48 hours, the sight might be totally lost. As the epidemic declined in intensity, the cases became fewer until they totally disappeared.

## XV.—ARTICULAR SYSTEM.

106. Arthritis was a common complication, and it appeared generally during convalescence. It was ushered in with febrile re-action, the temperature rising suddenly after having been low for a considerable time, with swelling and effusion into the joints. It ran a more or less subacute course; the joints principally involved were the shoulder, elbow, wrist, knee and ankle.

## XVI.—DIAGNOSIS.

107. Great reliance has been placed upon the bacteriological examination of blood as an aid to diagnosis, but this examination is neither very easy nor can it be lightly undertaken without previous experience, and when speedy examinations have to be made and the cases differentiated, it is not practicable. Under such circumstances reliance has to be placed upon clinical features alone, any doubts being subsequently set at rest by bacteriological examination and culture. And as culture alone is the safest guide in such cases, it is evident that it must take at least three days before a proper diagnosis can be arrived at, and by that time the patient may be no more in the land of the living.

108. Diagnosis of cases of *Pestis minor*, or extremely mild plague, and *Pestis ambulans* must perforce remain unsatisfactory, because of its transient and evanescent character in the one case, and of its prolonged and uncertain duration in the other. It is but reasonable to assume that neither the extremely mild form of plague nor the *Pestis ambulans* can be very infectious. Their natural history is against such a presumption, and it is yet to be shown that either the one or the other is capable of showing potentialities for mischief by assuming a malignant or infectious form. During the plague epidemic, both these types prevailed to a great extent, and so far they have not shown any capabilities of mischief or harm to the sufferer or to those around them. The diagnosis, therefore, of both these forms presents some difficulty, but after eliminating trauma, venereal infection and excessive strain, patients presenting an inflamed tender gland with slight fever, or a hard indolent mass with or without fever may be classed respectively as cases of extremely mild plague or as *Pestis ambulans*.

109. But the diagnosis of the simple bubonic, septic and pneumonic types is not difficult when partially or fully developed. The points to be specially noted in making such diagnosis are the following :—

1. *The presence of fever, high or low.*
2. *A quick, easily compressible pulse.*
3. *Furred tongue.*
4. *The aspect of the patient as shown by the facies pestica.*
5. *The peculiar hesitating broken speech.*
6. *The presence of a bubo.*
7. *Suffused eyes.*
8. *The presence of cough with rusty or hæmorrhagic sputum.*

These signs and symptoms, if carefully looked for, should not fail to ensure a correct diagnosis in either the simple bubonic, the septic or the pneumonic types, the bacteriological examination, if necessary, following for confirmation.

It is needless to enter here into anything like a differential diagnosis between bubonic plague and other affections, for its characteristics are peculiar, and the signs and symptoms enumerated above give a presumptive diagnosis in its favour.

110. Just as the milder varieties of plague are difficult to diagnose, so also are the non-typical forms, which constitute, so to speak, the rear guard of a dying or a diminishing epidemic. Lastly, the peculiar combination of plague and relapsing fever observed recently will require further study. In one case lately examined, spirilla were observed in the blood, and the plague bacilli in the sputum of the same patient at one and the same time.

#### XVII.—PROGNOSIS.

111. The prognosis in a case of bubonic plague is always grave, and any opinion to the contrary must be given with extreme caution.

The factors that intervene in the course of a plague case are so varied, the complications so sudden and so fatal, the chances of sudden death or collapse so obvious, and lastly the personal equation of each individual patient so important that no two cases are identical—all these combine against a hopeful prognosis and hence any opinion that has to be given should not only be extremely guarded but should vary with the varying condition of the patient, and no patient should be declared free from danger till the matter is beyond doubt. However promising a case may appear, a favourable prognosis is not safe as it is not possible to foretell what may happen, and time after time the most hopeful cases have succumbed, while some of the apparently hopeless have made a good recovery. And even after convalescence is fairly established, there are so many pitfalls and dangers looming ahead in the shape of complications, fresh infection of gland, marasmus exhaustion, and patients often suddenly take such an unfavourable turn, after progressing favourably for a time, that it is best to be very cautious in forecasting or giving premature hopes.

112. Prognosis in the pulmonic type of plague is the least hopeful, as very few cases recover. After that come the septic and then the simple bubonic cases with infiltration which are always grave and generally fatal; and as these occur most in axillary and cervical buboes, it stands to reason that the prognosis should be extremely unfavourable in them. *A high temperature, or sudden fall, sudden extension of infiltration, the simultaneous appearance of buboes in other parts of the body, sudden sharp diarrhoea and intense dyspnoea with or without dicrotic or beaded pulse,* are all signs foreboding impending dissolution and to them may be added sudden cessation of delirium. Haemorrhage or hæmorrhagic discharges are also grave.

113. Prognosis in the extremely mild form of plague, in *Pestis ambulans*, and in the non-typical forms of plague in which serous infiltrations do not press on vital parts is favourable, and no fatal cases have been observed in them. Apathetic cases are, as a rule, grave, a few only recovering. In conclusion, the desirability of extreme circumspection in giving a favourable prognosis cannot be too often reiterated.

## XVIII.—MORTALITY.

114. The mortality may be considered under the following heads:—

1. *General.*
2. *According to Caste.*
3. *do. „ Sex.*
4. *do. „ Age.*
5. *do. „ Age and Caste.*
6. *do. „ Occupation.*
7. *do. „ Position of Buboes.*
8. *do. „ Duration of Illness on Admission.*

1. *General Mortality.*

115. This has already been referred to in the administrative part of the report (*vide* para. 20) ; all that need be said here is that 32·58 per cent. of the total admissions were in a moribund condition and died within 24 hours of admission. The mortality rate for all cases stands at 73·26 per cent. and, excluding the moribund, at 60·34 per cent.

2. *According to Caste.*

116. The mortality according to caste and the sexes in each caste has also been referred to in para. 21. The general mortality for each of the castes is as follows ;—

Hindoos,	75·46 per cent.
Native Christians,	67·24 do.
Mussalmans,	66·38 do.

The number of Parsee and Israel patients being limited, their mortality rates have been excluded from comparison.

3. *According to Sex.*

117. The mortality in relation to sex amongst all classes stands as follows :—

Males,	73·24 per cent.
Females,	75·73 do.
Children,	66·66 do.

It appears that children had better chances of pulling through the plague than either males or females, the latter giving the highest death-rate of the two sexes.

4. *According to Age.*

118. The largest number of patients admitted was between the age of 20 and 30, the admissions totalling 327; next come those between 10 and 20 with 212 admissions; and then 183 between 30 and 40; lastly 113 between 40 and 50 years.

Then follow 43 admissions between 5 and 10 years, 33 between 50 and 60, 12 between 60 and 70, 8 between 70 and 80, 7 between 1 and 5, and one under one year. The highest mortality rate, 96·96 per cent., is found between the age limit of 50 to 60 years, and the least 65·11 between 5 to 10. In fact, the age

periods of the lowest mortality are between 5 and 30, showing that during young age and early adolescence, there is a better chance of recovery. The following table gives the details for the various age periods together with the number of deaths and recoveries and the mortality rate for the same :—

Age Period.							No.	Died.	Recovered.	Percentage of mortality.
Under	1 year	...	...	...	...	...	1	.....	1	0'00
From	1-5 years	...	...	...	...	...	7	5	2	71'42
"	5-10 "	...	...	...	...	...	43	28	15	65'11
"	10-20 "	...	...	...	...	...	212	140	72	66'03
"	20-30 "	...	...	...	...	...	327	224	103	68'50
"	30-40 "	...	...	...	...	...	183	147	36	80'32
"	40-50 "	...	...	...	...	...	113	97	16	85'84
"	50-60 "	...	...	...	...	...	33	32	1	96'96
"	60-70 "	...	...	...	...	...	12	8	4	66'66
"	70-80 "	...	...	...	...	...	8	7	1	87'50
Total							939	688	251	73'26

#### 5. According to Age and Caste.

119. The following table contrasts the mortality according to the age periods amongst the various castes :—

Castes.		Under	Years	Years	Years	Years	Years	Years	Years	Years	Years	Total.
		1 year.	1-5	5-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	
Hindus ...	693	Recovered ...	1	2	12	40	81	21	11	...	1	170
			Died ...	...	5	21	108	185	109	63	19	7
Mahomedans ...	119	Recovered ...	...	...	1	14	12	8	3	1	2	40
			Died ...	...	...	3	16	17	21	14	7	...
Native Christians	116	Recovered ...	...	...	2	17	10	5	2	...	2	38
			Died ...	...	...	3	15	19	16	20	4	...
Parsees ...	7	Recovered ...	...	...	...	1	...	1	...	...	...	2
			Died ...	...	...	...	1	2	1	...	1	...
Jews ...	4	Recovered ...	...	...	...	...	...	1	...	...	...	1
			Died ...	...	...	1	...	1	...	...	1	...
Total 939		Recovered ...	1	2	15	72	103	36	16	1	4	251
			Died ...	...	5	28	140	224	147	97	32	8

#### 6. According to Occupation.

120. This has been referred to in detail in para. 23.

#### 7. According to Position of Buboes.

121. It appears that the heaviest mortality was amongst those patients that had no apparent buboes, and most of whom suffered from the pneumonic type of Plague, which has been noted for its extremely high mortality. The mortality rate in them was 85'54 per cent. In those that had buboes, the highest mortality rate of 83'33 per cent. was observed in femoral and iliac buboes, and the lowest of 56'60 per cent. in simple inguinal buboes.

The axillary buboes showed a mortality rate of 82·14 per cent, contrasted with 77·77 in cervical buboes, 77·50 in femoral-inguinal buboes and 68·00 in femoral buboes. The excessively high rate in double buboes, *i.e.*, femoral and iliac-femoral, inguinal and iliac buboes is due to the fact that prolonged suppuration exhausts the patients, and gives them hardly any chance of recovery, but fortunately there were only 30 such cases.

The axillary buboes, numbering in all 140 cases, show the highest mortality in single buboes, and this is on account of the majority of them being septic cases, accompanied by extensive sero-sanguineous infiltration. They show higher mortality than even cervical cases, because of the fact that some of the latter were superficial and unaccompanied by infiltration and were consequently less grave.

The fatality according to the position of buboes may be stated as follows:—

Position of Buboes.	No.	Died.	Recovered.	Percentage of Mortality.
Inguinal ... ..	106	60	46	56·60
Inguinal and iliac ... ..	11	7	4	63·63
Femoral ... ..	275	187	88	68·00
Multiple ... ..	40	28	12	70·00
Femoro-inguinal ... ..	200	155	45	77·50
Cervical ... ..	45	35	10	77·77
Axillary ... ..	140	115	25	82·14
Femoral-inguinal and iliac... ..	17	14	3	82·35
Femoral and iliac ... ..	12	10	2	83·33
Without buboes ... ..	83	71	12	85·54
Total ...	989	688	251	73·26

### 8. According to Duration of Illness on Admission.

122. The mortality rate according to the duration of illness on admission can only be approximately correct, as it is, as a rule, almost impossible to obtain correct information either from the patients themselves or their friends. Such as it is, it is extremely instructive, and bears out what has already been said in previous paras. as regards the nature of the cases treated. The highest mortality rate of 80·46 per cent, was in those cases that were admitted on the third day of disease—in fact when the disease had become fully developed. Then come those admitted on the second and first day respectively with mortality rates of 79·18 and 77·14 per cent. Next follow the fourth day admission with 73·80 per cent, the fifth day with 71·87, and then there is a progressive decline just as the cases became older. Those admitted on the eighth and those on the fifteenth and over fifteen days show an almost equal mortality rate.



The first day admissions were comparatively few and show a high mortality rate, because they were, as a rule, very virulent cases. The following table gives the details according to the duration of illness on admission and their mortality:—

Days ill on Admission.	Admitted.	Died.	Recovered.	Percentage of Mortality.
1st day ... ..	31	24	7	77·41
2nd „ ... ..	221	175	46	79·18
3rd „ ... ..	256	206	50	80·46
4th „ ... ..	126	93	33	73·80
5th „ ... ..	96	69	27	71·87
6th „ ... ..	54	34	20	63·70
7th „ ... ..	34	20	14	58·82
8th „ ... ..	62	38	24	61·29
9th „ ... ..	7	4	3	57·14
10th „ ... ..	23	9	14	39·13
11th „ ... ..	.....	.....	.....	.....
12th „ ... ..	8	3	5	37·50
13th „ ... ..	2	1	1	50·00
14th „ ... ..	1	1	.....	100·00
15th day and over ... ..	18	11	7	61·11
	939	688	251	73·26

#### XIX.—CAUSES OF DEATH.

123. In the foregoing paragraphs allusion has been made to various causes that immediately contribute to the death of the patient, and they may be summarized here as follows:—The most important is failure of heart's action, and it may be either sudden or gradual; if the former, it may follow any sudden exertion or even supervene without any. In the latter case it comes on after cardiac weakness and from pulmonary mischief in the shape of œdema of the lungs and pneumonia. In cervical cases, the immediate cause of death is generally extension of inflammation to the deep connective tissue, and the larynx. Œdema of the glottis or a sudden sero-sanguineous infiltration pressing upon the vital structures of the neck often determines death also.

Hæmorrhages have not been observed in a sufficiently large number of cases to account for the immediate cause of death, and in describing the various systems, they have been alluded to. Uterine hæmorrhage and, hæmorrhage after abortion, as well as two or three cases of hæmaturia and malæna, have contributed to the death of the patient. In two cases there was a strong suspicion of internal (abdominal) hæmorrhage having contributed to the death of the patient, but it could not be verified as an autopsy was not possible. Marasmus and exhaustion from continuous drain upon the system on account of profuse purulent discharges, and consequent pyæmia may also be referred to as causes of death. But practically what kills the patient is either the heart or the lungs—in a majority of cases a combination of both.

#### XX.—CONVALESCENCE.

124. Convalescence is extremely tardy and patients go on lingering for a long time, day after day, without making the slightest progress. In the simple bubonic type, both complicated and uncomplicated, with secondary pneumonia, it

is impossible for days together to say whether the patient is making any progress or going backwards. The wounds, as already said, heal very slowly, the general strength of the patient takes a long time to recover, and, above all, unforeseen complications often retard speedy recovery. Such complications and mishaps interfere very greatly with convalescence.

#### XXI.—SEQUELÆ.

125. Amongst the sequelæ of Plague may be noted aphasia, which is generally temporary, peripheral neuritis, irritability of temper, imbecility and insanity. These are in fact all the nervous sequelæ left behind as legacies in that form of the nervous state which has been called apathetic. General constitutional weakness and debility must, of course, remain for a considerable time to remind the fortunate patient of his sufferings from Plague. And at times arthritis, which has been noted as a complication, may persist for some time. The persistence of buboes in a more or less indolent condition, and their subsequent absorption or breakdown have already been noticed.

#### XXII.—RELAPSES OR REINFECTION.

126. Reinfection or Relapse—a by no means infrequent complication of convalescence, generally from local extension, has not been observed to occur in cases that have been discharged perfectly recovered from the Hospital, and it is a question open to further observation whether genuine relapses or reinfection of the system are possible. In only one instance did a patient return to Hospital a month after his discharge with symptoms of intense pain in the abdomen and peritonitis, and it was suspected that it might be a case of relapse involving the mesentery and its glands. But it was not possible to determine the exact nature of the case, as the patient succumbed within a week, and no *post-mortem* examination was possible. Up to the time of writing this report (October 1897) no cases of genuine relapse have been observed.

#### XXIII.—LATENT DISEASES.

127. Some affections seem to remain dormant during Plague infection, and break out with all their virulence during convalescence in patients already exhausted and debilitated through it. Phthisis, malaria and acute tuberculosis may be included in this category. Phthisis has been observed to make a regular galloping progress, once the patient has entered into a period of convalescence, malaria also asserts itself with great virulence, still further exhausting and debilitating the patient by the rapid rises and falls of temperature. Tuberculosis has also been observed to supervene and end fatally in convalescent Plague patients.

#### XXIV.—DISCHARGE OF PATIENTS FROM HOSPITAL.

128. Certain rules and precautions were observed before patients were finally discharged from the Hospital. In those cases where buboes ended in resolution, the patients were not discharged till the buboes had completely disappeared. When the buboes remained indolent, the patients were kept under observation till such time as they showed a tendency to diminish in size or dis-

appear. In case they suppurated, the case was treated as in an ordinary acute suppuration of the bubo, and the patient was not discharged till his wounds had become perfectly healed, and a firm cicatrix had formed. The period during which patients remained in Hospital varied from 10 days as in a few cases, where the buboes ended in resolution, to 8 to 10 weeks, and some of the convalescent patients who were transferred to the Parel Hospital were not finally discharged till after more than 3 months.

## XXV.—TREATMENT.

### I.—Preventive Treatment.

129. Preventive treatment was directed towards lessening the risk of infection amongst the Hospital staff and ward attendants who came in such intimate contact with the sick. The essentials for this were perfect and free ventilation, as free as the patients could tolerate without risk of getting chilled. Of this there was no lack in the Hospital, and although a large number of patients were congregated together, there was no smell in the wards on account of the efficiency of ventilation. The attendants were instructed to cover any wounds or abrasions on their bodies and to frequently wash and disinfect their hands and change their clothing. In the early days, sulphurous acid gas was the disinfectant used, the wards being constantly fumigated; subsequently chloride of lime was substituted. The floors were kept sprinkled with either strong carbolic lotion or carbolic powder, and latterly naphtho-sublimate powder (consisting of sulphate of lime, naphthaline, corrosive sublimate and sulphate of copper) was used. All the clothing and other belongings to the patients were destroyed by fire, and all the sheets, blankets, pillows, quilts, &c., used for the patients were similarly treated. Each patient was provided with a low wooden cot, taped or caned, and one quilt, one blanket, one or more pillows, one sheet and a piece of Mackintosh or India-rubber sheeting. The fæces and urine were disinfected with either strong carbolic or sublimate lotions; and the sputum was received in vessels containing either sublimate or carbolic lotions. These measures proved extremely satisfactory inasmuch as only three ward attendants caught the infection, all of whom fortunately recovered. None of the Hospital staff were inoculated with Professor Haffkine's preventive serum. The late Dr. Davda had, however, 10 c.c. of Dr. Yersin's serum injected as a preventive about three weeks previous to his illness.

### II.—Curative Treatment.

130. To speak of curative treatment in relation to Plague is a misnomer, for there is no curative or specific treatment for it, and all the means at our command can do, is simply to tide the patients over the most critical period and to assist nature in recovering her original sway over the system. In fact, the patients that left the Hospital alive might more fitly be described as *recovered* than *cured*. Drugs, no doubt, have a value, and a considerable value, in the treatment of Plague, but it is limited, and beyond that limit it is not possible to go. They have shown by their action how their uses and applications could be varied, and how the system under the influence of the Plague poison could be made to tolerate enormous, even actually poisonous doses of certain drugs—doses which one would hesitate to prescribe under ordinary conditions. The two drugs that the patients tolerated so well were strychnine and morphine, and both of them

could be pushed to more than the utmost limit of ordinary tolerance, not only without any harm but with actual benefit to the patients. The uses of others will be referred to in subsequent paras.

131. Before entering into the details of treatment, it will be just as well to refer here to the dieting of patients, which forms no insignificant part of the treatment of Plague. It was essentially a milk diet consisting of sago, arrowroot or rice conjee, with as much milk as the patients could be made to take. During the acute stage, all meat preparations in any shape, fresh or preserved, were strictly prohibited, and it was only when the patients entered the stage of convalescence that either fresh mutton broth or cooked mutton or eggs, in the shape of egg-mixture were allowed. The reasons that led to the adoption of this system, were, *firstly*, the fact that the majority of the patients belonged to the non-meat-eating class, to whom the administration of meat in any form would have been certainly detrimental; and, *secondly*, it was considered highly injudicious to overcharge the system with extractive matters derived from the meat, especially when the kidneys were in anything but a healthy condition, and were already unable to eliminate the waste products of the system. Moreover, it is notorious that the extractives, of which essentially most of the commonly-used meat preparation consist, only stimulate but do not nourish the patient, and, as in alcohol, strychnine, etc., we certainly had better and safer stimulants, the extracts were discarded. This procedure was adopted after much consideration and in the teeth of opposition from those who pinned their faith in Liebig's and who indiscriminately poured it down the throats of all patients. There has been no reason to regret its adoption, and it has yet to be shown that in the class of patients that this Hospital had to deal with, meat preparations would have proved more useful than a purely milk diet.

132. So long as the patients would or could be made to take medicines and food, there was no apprehension; but in a large number of cases this was difficult, and both food and medicines had to be administered with considerable opposition from the patient. Under such circumstances, and when the patients were either violently delirious or in the apathetic condition, feeding through the mouth or nose by the esophageal tube had to be resorted to time after time. But often even this was difficult, and then combined nutrient and medicated enemas had to be given, the patients being kept alive for days together on them. The usual practice was to give a six to eight ounce enema every six hours. They were generally retained, and the patient's strength and life were prolonged and in many cases actually saved.

133. The indications and lines of treatment laid down were the following:—

1. *To keep up a regular action of the bowels, &c.*
2. *To control the febrile state.*
3. *To control the delirium.*
4. *To sustain and support the heart's action.*
5. *To treat the buboes and to act directly, if possible, on the system through treatment directed to the lymphatic system.*
6. *Symptomatic treatment directed towards such complications as arose in the course of the affection.*
7. *Sero-Therapy.*

1. *To keep up a Regular Action of the Bowels, &c.*

134. Unless there was diarrhoea, or the patient was in a moribund condition, a purgative consisting of 5 grains of calomel and 10 grains of bicarbonate of soda was administered. It was found sufficient in the majority of cases and, as a rule, acted well. An enema of warm water, either with or without tinct. iodine (dr.  $\frac{1}{2}$ -1 to 1 pint) was also administered, and before the patients were put to bed they were thoroughly washed and cleaned. Santonine was usually added to the powder, as most of the patients suffered from ascarides. If constipation persisted during the course of the illness, the purgative as well as the enema were repeated, and the enemas seemed always to exert a favourable influence in controlling and keeping down the temperature. In many cases they were given daily.

2. *To Control the Febrile state.*

135. The one important principle that guided us in the choice of means for controlling the temperature was to avoid anything that would depress the heart and circulation, as it was well known that the plague poison exerted a specially deleterious influence on the circulatory system. With this view, all depressants in any shape whatever were excluded, not a single grain of any of the coal-tar antipyretics or even of the salicylates was used. The reasons for this are so obvious that they need scarcely be referred to. Ordinary diaphoretics were found to be of not much use, as they upset the stomach very often, and neither quinine, iodine nor carbolic acid, used either alone or in various combinations, had the slightest effect in controlling the temperature, and after a fair trial in a few cases they too were discarded; quinine alone being resumed in small doses with iron as a tonic during convalescence. Guaiacol was also used externally, but was soon dropped on account of its depressant effects. Reliance had, therefore, to be placed mainly on the external application of cold to reduce the temperature, and ice-bags on the head, sponging with water at ordinary temperature, or iced, wet-pack and iced wet-pack were the means used. The ice-bag had to be kept tied on the head, otherwise it was extremely difficult to keep it in position. Sponging generally brought down the temperature, but for a short time only. The wet-pack was, however, the most efficient means of controlling the temperature, and patients were kept for hours together under it with very great benefit. The temperature after having been once reduced was prevented from rising, delirium was controlled, the patient remaining quiet and soothed, and there was not the depression following its use, which is often observed after the administration of antipyretics.

3. *To Control the Delirium.*

136. Bromide and hyoscyamus with cold on the head were the means used first to control ordinary mild delirium. And very often, though it could not be altogether checked by these means, the nervous system was to some extent soothed. But when the delirium was very acute and active, preventing the patient from sleep, feeding, &c., resort had to be had to morphia which proved far the most efficient remedy. A bromide and morphia draught was usually adminis-

tered, and, failing that, subcutaneous injections of morphia were resorted to. These were repeated time after time as required, so that some of the patients were kept for long periods under its influence. The dose varied from  $\frac{1}{8}$ th to  $\frac{1}{2}$  a grain according to the nature of the case. But in some cases morphia alone seemed to be powerless in controlling the delirium, and then atropine had to be used, either alone or in combination with it, the dose of morphia varying from  $\frac{1}{8}$ th to  $\frac{1}{3}$ rd of a grain, and of atropine from  $\frac{1}{30}$  to  $\frac{1}{20}$  of a grain. Sometimes even this failed, and atropine alone in doses of  $\frac{1}{10}$ th of a grain had a very good effect. Bromidia was used in a few cases, but without much benefit. Hyoscyamin sulphas and hyoscyne hydrobromate were both used, and though the latter is not so powerful a depressant as the former and acts better, still both are dangerous drugs to use, as the good that they do is more than counterbalanced by their depressant after effects. Their action in some cases, however, was simply marvellous, but it was purchased often at too great a cost. Consequently, their use was not continued. Hardly any chloral was used by itself either to control the delirium or produce sleep.

It may also be stated that the use of morphia is not unattended with dangers, and that it is advisable to begin always with a small dose. Occasionally its effects show themselves as extremely depressing; the patient is difficult to rouse, and may be bedewed with cold clammy perspiration.

Blistering the nape of the neck is hardly of any use.

As the indications for the control of the delirious state include those for producing sleep also, no separate details are necessary.

#### 4. *To Sustain and Support the Action of the Heart.*

137. With this object reliance had to be placed upon alcohol, ammonia, ether, strychnia, digitalis and strophanthus. The form in which alcohol was used was Jamaica rum, occasionally brandy or cocoa wine, the latter especially in the case of infants, children and females. The average quantity of rum per patient per day may be put down as from 4 to 6 ounces, but this was often exceeded. It was suggested that the quantity might be raised to 24 ounces per day, as had been done in the treatment of typhus; but it was not possible to use such enormous doses both on account of the want of tolerance produced by them, as well as disturbance of the stomach, especially in those not habituated to its use. The dose given was considerable, seeing that ammonia and ether were also given along with it. Ammonia in the form of spirit ammonia aromatic was used. Strychnia was given both by the mouth and hypodermically, the patients taking in 24 hours from  $\frac{1}{2}$  to  $\frac{4}{5}$ ths of a grain of strychnia by the mouth, in addition to from  $\frac{1}{20}$ th to  $\frac{1}{10}$ th of a grain hypodermically. In fact, strychnine was the most reliable drug in supporting and sustaining the heart's action, in addition to its effects as a powerful nerve stimulant. Besides strychnine, digitalis, digitalin and strophanthus were largely used. Tincture digitalis was given internally to the extent of minims 40 to 60, or even 90, per day, and digitalin subcutaneously in  $\frac{1}{100}$  grain doses from two to four times. Digitalis by the mouth and strophanthus hypodermically, however, gave better and more lasting effects than digitalis and digitalin, the effect of the latter appearing to wear off much sooner. There was no danger from any cumulative action. Tincture strophanthus was also tried internally, but the above combination gave certainly better results.

The usual hypodermic dose of tincture strophanthus was 3 minims from twice to four or six times daily according to the state of the pulse. The preparation, which was ordinarily used, consisted of liquor strychnia 2 minims, tincture strophanthus 3 minims, and rum 15 minims.

138. There was, however, a difference of opinion as regards the value of digitalis in Plague. Some thought that it acted just like flogging a jaded horse, giving the heart a temporary spurt, and that after its effects had worn off, the heart relapsed into its previous condition, and became more exhausted than before on account of its degenerated condition, that the heart muscle by much and frequent stimulation got paralysed, and that the proper treatment in such cases was peripheral stimulation by ammonia, ether, and strychnia which assisted the circulation by giving it a *vis a tergo*. Against this view had to be put another, *viz.*, that, as in other acute infective diseases, the heart muscle shares the same state of degeneration with the other organs, and whatever changes take place in it are temporary and recovered from after the patient's convalescence; therefore, in this condition of acute degeneration, digitalis was the proper drug to use and that it did not exhaust the heart by over-stimulation, rather that the heart was generally insufficiently stimulated, and hence failed to re-act properly to the drug, and thus it was not because of the digitalis that the heart failed, but from the want of it. This conclusion is further supported by the extensive use of digitalis in large doses in typhoid fever, pneumonia and other acute infective diseases, in which it is said that, if properly used and in adequate doses, it is *the* remedy; and, consequently, it should be used similarly in Plague and pushed as far as possible. Either the infusion or the fine powder of the leaves should be used, preferably the former, and large doses of it should be administered. It appears from our experience that it would be certainly a mistake to discard either digitalis or strophanthus, and that the intermittency of the pulse, which has been ascribed by some to its use, is rather the natural intermittency that follows in the circulatory cycle in Plague, and that it would have perhaps been averted by pushing digitalis further in large doses. It was because there was a judicious combination of both peripheral and central stimulation that our efforts so often proved successful in reviving almost moribund cases, and in keeping up the action of the heart in a flagging circulation. The effects of large doses of digitalis alone it was not feasible to try during the period covered by the report, and later on, when it was, there was hardly any chance of giving it a fair trial on account of the patients coming in at such an advanced stage. It is to be hoped that further trials with large doses may be made in future to settle this extremely important question.

Heart failure can rarely be arrested by any means that we know of.

6. *Treatment of Buboes and Directly of the System, if Possible, through the Lymphatic System.*

139. The main indication in the treatment of buboes consisted in relieving the pain by soothing applications, counter-irritation where possible, and such means as could be adopted towards hastening suppuration of the buboes. Glycerine and belladonna, unguentum iodi with extract cannabis indica and extract opii and hot linseed-meal poultices were applied to that end. Poultices, however useful

in single isolated painful glands, proved, however, distinctly harmful in the septic type of Plague with extensive infiltrations, for they seemed to increase the area of infiltration. Latterly, poultices have been entirely discarded, except in cases where the buboes appear soft and about to break down when they hasten suppuration and prove useful. The application of cold in the shape of ice, cold compresses and ice-bags had a distinctly beneficial effect, not only in subduing pain, but also in lessening the existing infiltration and preventing fresh. So that ice-bags have been now adopted almost universally over the buboes.

140. Once the bubo showed signs of suppuration, it was incised and the contents evacuated. Incisions to be useful should be free and attempts should always be made by enlarging the incision, if necessary, to remove all the sloughs. A thorough evacuation of pus and removal of sloughs always saves a great deal of after-trouble and mischief, and ensures at the same time rapid healing of the wound. The dressing which has been always used and has proved very efficacious was tincture of iodine (3 i to 1 pint of warm water). Often this strength was exceeded and with very good results. The wound was thoroughly irrigated with the lotion, and plugged with lint, pressed almost dry after saturation in the same. This mode of dressing with iodine had a distinctly beneficial effect, and accounts for a good many rapid recoveries. Iodoform was used only in such cases as were unhealthy or foul, and it gave good results in them.

141. Incision of acute buboes and subsequent dressing with iodine was tried in a few cases, but without any good results.

142. The treatment of infiltrations was always a serious matter, not only on account of their extent, but also because they almost invariably appeared in the graver or septic type of Plague. If recent, and moderate in extent, and serous or slightly sero-sanguineous, they could, to a certain extent, be controlled by the use of ice-bags, and the internal administration of chloride of calcium, in doses of from 10 to 15 grains six times a day. It is needless to remark here upon the action of cold in such infiltrations, as the explanation suggests itself. Under its influence and that of calcium chloride not only was further infiltration checked, but often infiltrations used to go down in a remarkable manner in about three or four days; and if a bubo was involved in the same, it generally suppured. The use of calcium chloride suggested itself on account of its well-known power of increasing the coagulability of blood, as discovered by Professor Wright of Netley, and his advocacy of the same as a hæmostatic. It was assumed that, on account of these properties, the salt would at any rate prevent further infiltration or exudation, and this was borne out in such cases as had a fair trial. It showed a marked power in controlling the acute infiltration of septic cases, and also of the non-typical cases that were observed during the decline of the epidemic. Whether it had any share in their rapid absorption is open to doubt.

143. But in those cases where infiltrations are recent and purely hæmorrhagic, or of some duration and consolidated, hard and stony, hardly any treatment is possible; and it stands to reason that, when large coagula are interspersed between the muscles, and held down by the connective tissue, scarcely any treatment is possible. When incisions are made into them, the knife seems to feel as if cutting through a hard cheese, there is scarcely any bleeding, and the incisions soon



close up without leaving any traces. Neither heat nor cold can have any influence, and such cases almost always terminate fatally.

144. The treatment of necrotic processes and gangrene has already been referred to, while considering the cutaneous manifestations of Plague. Corrosive sublimate has been shown to exert a peculiarly favourable influence upon their spread.

145. As the natural termination of the buboes appeared in a majority of cases to be in suppurations, and, as with the completion of the process of suppuration the patient seemed to enter into the convalescent stage, attention was naturally directed to the treatment of buboes and through them of the system if possible. The original idea with which the intrabubonic injections were practised was that of influencing the course of the disease through them, as the poison seemed to exert all its influence primarily on the lymphatic system, the system showing the effects of the toxins generated in it, and subsequently absorbed from it. It soon, however, became evident that the injections acted in another way. Though in some cases the temperature fell and the general condition of the patient improved remarkably soon after the injections, yet in by far the majority of cases, the effects were not on the system except perhaps in the case of temperature, but mostly local. And this consisted in hastening the process of suppuration, and whatever means that contributed to this end led the patient into an earlier stage of convalescence. So the original idea had to be discarded, and the purely local effects of the injections watched. In a certain number of cases it appeared that suppuration did take place earlier, and that the injections had the effects of bringing this about. But after all has been said in their favour, there remain certain elements of doubt, and it must not be presumed that this line of treatment is successful in all cases. All that is claimed for it here is that it certainly showed appreciable and well-marked results, considering the nature of the cases that had to be dealt with.

146. The cases were not particularly selected for injection, except in so far that those that looked actually moribund were not injected, and a large number of other cases were also not injected in order to institute a comparison between the two modes of treatment. In all 320 cases were injected, of which 220 died and 100 recovered, giving a mortality rate of 68·75 per cent. Against this have to be compared 619 cases that were not injected and of whom 468 died and 151 recovered, giving a mortality rate of 75·60 per cent., so that, taking all in all, the injected cases showed a better mortality rate by nearly 7 per cent., but if the injected cases that died within 24 hours of admission be excluded from this, the rate would stand at 60·78 per cent., that is, the injected cases would show a better mortality rate by 15 per cent. than the uninjected:—

	No.	Died	Recovered	Mortality rate.
Injected cases ... ..	320	220	100	68·75*
Non-injected cases ... ..	619	468	151	75·60

\* If those that died within 24 hours of admission be excluded, it would be 60·78 per cent.

It thus appears that the injected cases do show better results than those not similarly treated. These results would have been still more striking, were it not for the fact that the records of the cases during the first four months of the epidemic are not complete, and in many instances, injections were made but not recorded. Iodine was the drug used in the majority of cases, injected either alone or with carbolic acid and in this way 278 cases out of the 320 were injected. The following table is appended to illustrate the injections used and the results; but, as stated above, it is not complete, and consequently not conclusive. Suffice it to say that it indicates the results of efforts directed towards one particular channel of treatment, which might yet be given a more extensive trial in the future. So much, however, depends upon the nature of the cases, the stage during which they are admitted and their conditions, that, in order to obtain any reliable results, all the factors should be given their due prominence, but this could not unfortunately be done in the hurry and stress of work and the limited time at the disposal of the staff:—

—	No.	Suppurated.	Resolved.	Died.	Recovered.
Iodised oil (5 p. c.) ... ..	8	5	1	2	6
Liquor iodi B. P. (5 p. c.) ... ..	100	25	4	71	29
Acid, carbolic ... ..	11	3	1	7	4
Liquor iodi and acid, carbolic ... ..	170	36	15	119	51
Creolin ... ..	20	...	6	14	6
Quinine ... ..	4	1	...	3	1
Mercurial preparations—Corrosive sublimate and red iodide of mercury ... ..	7	3	...	4	3
Total ...	320	73	27	220	100

Liquor iodine B. P. was usually employed, the dose for each injection being 10-20 minims, equal to gr.  $\frac{1}{2}$  to 1 of iodine. One injection was the usual rule, but, if the temperature persisted, another was given after 24 hours. When liquor iodi and acid carbolic were injected together, minims 10 to 15 of liquor iodi and 10—5 of acid carbolic, respectively were used. Acid carbolic, when injected alone was in 5 minim doses, and creolin in 5 minim doses. Of quinine,  $2\frac{1}{2}$  grs. was the quantity for each injection. The injections were made in the substance of the bubo, a small quantity being gradually injected as the syringe was withdrawn.

147. Of the 22 cases that came in at a late stage with the buboes, either completely suppurated or in the process of suppuration, 18 recovered and 4 died, giving a mortality rate of 18.18 per cent., and this goes to illustrate that the above cases, semi-convalescent as they were, had other dangers to face, and that more than one-fifth of them eventually succumbed from the various complications that arose during the convalescent stage. And it also emphasises the fact that, although the disease may practically be considered terminated with the completion of suppuration, the patient is not really cured.

#### 7. Symptomatic Treatment.

148. Besides the lines of treatment laid down above, a certain number of symptoms, more or less persistent and distressing to the patient, require a passing consideration.

The laryngeal distress and intense dyspnoea caused by pressure or extension of inflammation in the neck is markedly relieved by the subcutaneous use of morphia, and though morphia did not cure any of these cases, it certainly relieved the patients, very greatly easing the distress, procuring sleep and permitting some amount of nourishment, and perhaps bringing about euthanasia.

Vomiting and hiccough were at times very persistent, and of all the drugs cocaine seemed to exert the most marked effect in controlling them, and sometimes drop-doses of vinum ipecacuanha; diarrhoea was controlled by bismuth, salol or dermatol, and thirst was relieved by ice and effervescent drinks, &c.

Pneumonia was treated on general principles, and so also were the eye complications.

Attention had frequently to be devoted to the bladder, which required relief by catheterisation.

#### 7. Sero-Therapy.

149. Sero-therapy was tried on an extremely limited scale and the serums that were used were those of Professor W. M. Haffkine, C.I.E., and of Dr. Yersin; also a serum prepared in Russia according to Yersin's method, and that of Professor Lustig of Florence; both Professors Haffkine's and Lustig's serums were, what may be called, experimental, and by no means perfected, and both the Professors, before giving them a trial, disclaimed anything like finality or perfection either in their mode of preparation or application. 15 cases in all were injected by Professor Haffkine; of these, 9 were cured and 6 died, giving a mortality rate of 40·00 per cent.; 14 of these were acute cases, of whom 6 died and 8 recovered, giving a mortality rate of 42·85 per cent. The other case was not making a favourable progress, although fairly convalescent, and the serum was injected with a view to hasten his recovery, and he recovered. In order that the patients might have the best chance of recovery possible, Professor Haffkine did not think it advisable to stop the regular routine treatment which was carried on just as usual, the serum forming a supplemental treatment.

150. Yersin's serum which was said to effect miraculous cures was tried only in three *very early* cases, which alone Dr. Yersin considered amenable to his serum. The mildest of them recovered after a very long and protracted convalescence, the two others dying within 24 hours of the injection.

The Russian serum prepared according to Dr. Yersin's method was tried by Professor Lewin of the Royal Military Academy of St. Petersburg, and it failed to show any results even in a single case, as all the cases so injected died.

151. Professor Lustig's serum was tried in six very serious cases during June and July, and the result of the treatment was exceedingly satisfactory. All the six cases so treated recovered. Even if it be assumed that the cases, though severe, were in the decline of the epidemic, and therefore less virulent, still the cent. per cent. recovery rate is remarkable and shows distinctly that the serum had

an extremely favourable influence. It may be added that the usual routine treatment was continued in these cases also at Professor Lutsig's request.

152. Only one case, in which Professor Haffkine's prophylactic serum had been injected before Plague developed, came under observation in this Hospital.

#### XXVI.—POST-MORTEM APPEARANCES.

153. If it were possible to convey in one word the principal *post-mortem* signs of the changes that are found in the system, that word would be *hæmorrhage*. Hæmorrhages in every conceivable and inconceivable part of the body, hæmorrhages in the dura-mater, in the larynx, in the mediastina, in the epi- and peri-pleura, in the epi-, peri and endo-cardium, and in the myo-cardium, in the lungs, in the stomach, in the intestines, kidneys, liver and spleen, in the bladder, in the intima of the vena cava and jugular veins, hæmorrhages in and around the buboes and in the subcutaneous cellular tissue of the neck, chest, arm, forearm, thigh, and legs and even in the retro-peritoneal connective tissue. These hæmorrhages in one form or another were observed in all the 54 autopsies that were made, varying in extent in the organs affected, according to the nature of the case. It may be as well, however, to give a brief summary of the *post-mortem* appearances observed in the various parts of the body.

##### 1. *Brain and Membranes.*

154. The meninges were injected, but hardly any traces of acute inflammation were found, except in one case. Hæmatoma of dura-mater was once observed; excess of fluid in the arachnoid cavity was well marked in a few cases, the ventricles being full, and the choroid plexuses œdematous and swollen. The brain substance showed no gross lesions, but it appeared softer than usual, the convolutions being swollen and œdematous. In fact, stasis had produced changes in the brain similar to those in the lungs, namely, œdema, but in a less degree on account of its peculiar circulation. No hæmorrhage was found in the brain substance.

##### 2. *Spinal Cord.*

155. The spinal cord with its coverings was examined in a few cases, but beyond congestion nothing else was noticeable.

##### 3. *Pharynx.*

156. The pharynx was generally found congested, especially so in several cases with infiltrations. A pseudo-diphtheritic membrane of a dirty greyish brown colour was seen in a few cases covering it, as well as the tonsils, and extending towards the larynx.

The tonsils showed occasionally abscesses within their substance, with acute inflammation and some hæmorrhage.

#### 4. *Larynx.*

157. The larynx was injected and inflamed and in some cases hæmorrhage was noticed beneath its lining membrane. The structures surrounding it as well as the soft parts that line it were œdematous, and the aryteno-epiglottidean fold was often found to be greatly swollen and œdematous, blocking the entrance and exit of air. The pseudo-diphtheritic membrane above referred to, was noticed in two or three cases to extend to the larynx with deep cervical buboes and infiltration; the laryngeal symptoms were as a rule well marked.

The thyroid was generally found to be normal. The trachea showed nothing beyond injection.

#### 5. *Lungs and Pleura.*

158. The lungs were practically "blood-full" and in most cases when there was not much extensive pneumonia, greatly œdematous. On section, a large amount of sero-sanguineous fluid flowed out of them—in fact they seemed to be thoroughly soaked in it like a sponge. The mucus in the bronchioles was frothy and blood tinged. If pneumonia existed, it was of the characteristic lobular type, in isolated patches, having a mottled grey appearance, generally well raised above the surrounding lung surface, and surrounded by a ring of congested lung, gradually merging into healthy lung tissue.

Hæmorrhagic infarcts abscesses, and occasionally a stray tubercle were noticed in some cases. Pleurisy was sometimes met with, and was of a fibrinous character. Hæmorrhages more or less extensive were noticed on the parietal visceral and diaphragmatic pleura, the latter being the least frequent, and of the two former, parietal pleura being the most often noticed with large hæmorrhagic patches. Hæmorrhages were also observed in the connective tissue of the anterior and posterior mediastina. The bronchial glands were observed in a few cases to show the characteristic tumefaction and swelling of plague.

#### 6. *Heart.*

159. Pericardial fluid was found in some cases to be larger in quantity than normal. Hæmorrhages were found on the pericardium, epicardium and also endocardium. They were also met with in the substance of myocardium, which was generally soft and in a state of acute degeneration, occasionally fatty. In some cases it was so soft that it could be rendered pulpy between the finger and thumb. The cavities were generally dilated, the aorta normal, and occasionally fresh vegetations and hæmorrhages were observed on the valves.

#### 7. *Esophagus.*

160. It was generally normal, but in such cases as had extensive hæmorrhage in the gastro-intestinal mucous membrane, it also shared in the same and showed occasional hæmorrhages.

#### 8. *Stomach.*

161. The stomach was hardly ever found to be in a normal state, its mucous membrane was generally bile-stained and showed hæmorrhages which were extremely characteristic, inasmuch as they were always punctate, the same

character being also noticeable throughout the intestinal tract. In the absence of hæmorrhages there was occasionally intense injection and fresh erosion of the mucous membrane.

#### 9. *Liver.*

162. The liver appeared generally slightly swollen, "blood-full" and in a state of acute infective degeneration, occasionally fatty. Its substance was soft and friable, and the capsule at times adherent. In one case only emboli of plague bacilli were noticed.

The gall bladder was almost always full, containing thick, viscid, dark-greenish bile.

#### 10. *Spleen.*

163. The spleen showed an acute tumor or enlargement, but not large enough to become prominent. It was generally in a state of acute degeneration, the capsule was adherent, and its substance soft, pulpy and, in some cases almost diffuent, the spleen appearing like a bag containing a homogeneous jelly. Hæmorrhagic infarcts were noticeable on its surface beneath the capsule, and occasionally small abscesses and cysts were present. On section, the colour was of a deep chocolate brown, sometimes almost hæmorrhagic, the malpighian bodies were swollen, and could, occasionally be distinctly seen, and so also the trabeculæ and the fibrous structure. In cases that had suffered from malaria, the peculiar dark pigmentation due to it was also noticed.

#### 11. *Kidneys.*

164. The kidneys were in a state of acute parenchymatous degeneration, the capsule adherent and stellate, and other hæmorrhages and hæmorrhagic infarcts were noticed in its substance. The cortex was thin and the pyramids swollen, and so also were the malpighian capsules which were at times traceable; small cysts and abscesses were also noticed in its substance. The suprarenal capsule appeared to be normal.

#### 12. *Mesentery.*

165. The mesentery also showed hæmorrhages, and they were besides noticed in the retro-peritoneal connective tissue and in the loose connective tissue in the abdomen, surrounding the various organs. In some cases hæmorrhages were noticed on the inner aspect of the abdominal wall and also between the recti-muscles. The mesenteric glands were not often seen to be much enlarged or infected. Whenever there was plague infection they showed slight tumefaction and swelling, and could be at once made out from their dark purplish colour and from the hæmorrhages surrounding them.

Hæmorrhages were also noticed in the ovaries as well as around the iliac glands. Whenever the glands along the course of the vena cava showed infection, hæmorrhages were noticed in the connective tissue around them as well as in the intima of the vein extending several inches both ways. The same was also noticeable in the case of jugular and femoral veins.

13. *Intestines.*

166. The intestines, small and large, showed punctate hæmorrhages, and in one case these hæmorrhages extended from the esophagus to the rectum. The mucous membrane was generally found slightly inflamed, and sometimes slight ulceration was noticed.

14. *Buboes.*

167. The appearance presented by the buboes was quite characteristic, and their section, whenever infected, always showed characteristic appearances such as are not met with in any other affection. They were swollen, enlarged and surrounded by sero-sanguineous or hæmorrhagic exudation. On section, they appeared of a dark-purplish colour and "blood full," and the appearance, as stated above, was always characteristic. The exudations around the glands have been already described, and so also the cutaneous manifestations found during life. Whenever the parotid was enlarged, it appeared like a large lobulated mass, varying in size from four to six inches, and on section all the small component lobuli stood out distinct.

15. *Bones and Joints.*

168. The marrow of long bones like the femur was often noticed in a state of acute red degeneration, as in other infective diseases, and the synovial fringes in the knee-joint distinctly infected.

169. The *post-mortem* appearances above described are from 54 autopsies that were made in this hospital, 47 by the members of the Austrian Plague Commission, and the rest by the hospital staff. The thoroughness, the extreme care and the intelligence which characterised these *post-mortems*, each of them being a complete demonstration, reflect great credit on Dr. HEINRICH ALBRECHT, the head of the Commission, and his assistant, Dr. A. GHON, who conducted them, and I must own my deep sense of obligation to them for the way in which they utilized the material I had provided, and which forms the basis of these notes, and whatever credit attaches to them, belongs to Dr. H. ALBRECHT.

170. Lastly, I must express my most sincere thanks to Dr. HERMANN FRANZ MULLER, PRIVAT-DOCENT at the Klinik Nothnagel, Vienna, and Dr. R. POCH, the other members of the Austrian Commission, for their ready co-operation and assistance to me during the time they were associated with me in studying the disease in its clinical aspects.

N. H. CHOKSY,  
*Extra Assistant Health Officer*  
*in Medical Charge.*

ARTHUR ROAD HOSPITAL,  
BOMBAY, 28th October 1897.

# CHART I

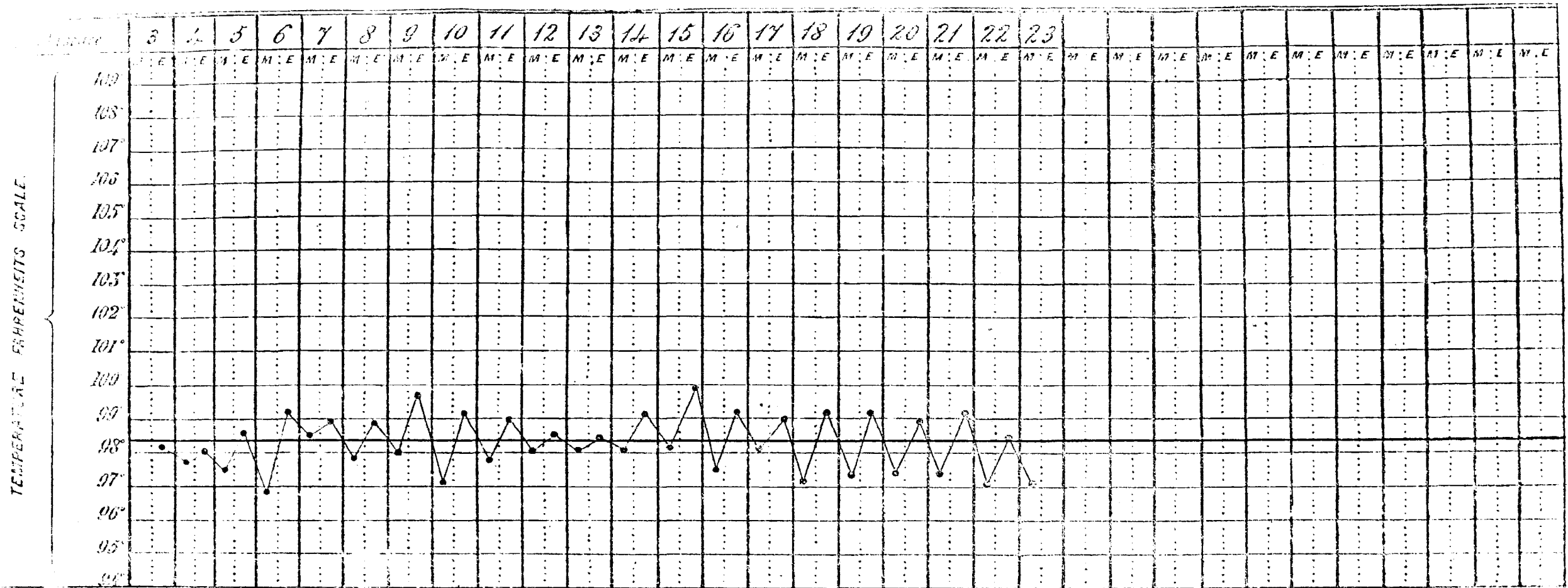


Chart of a case of Pestis Ambulans, with right femoro—inguinal bubo, ending in resolution : the patient's temperature remained slightly above the normal, and she was greatly prostrated. The temperature on the 1st and 2nd day was reported to have been 101° and 102° respectively.



## Chart II

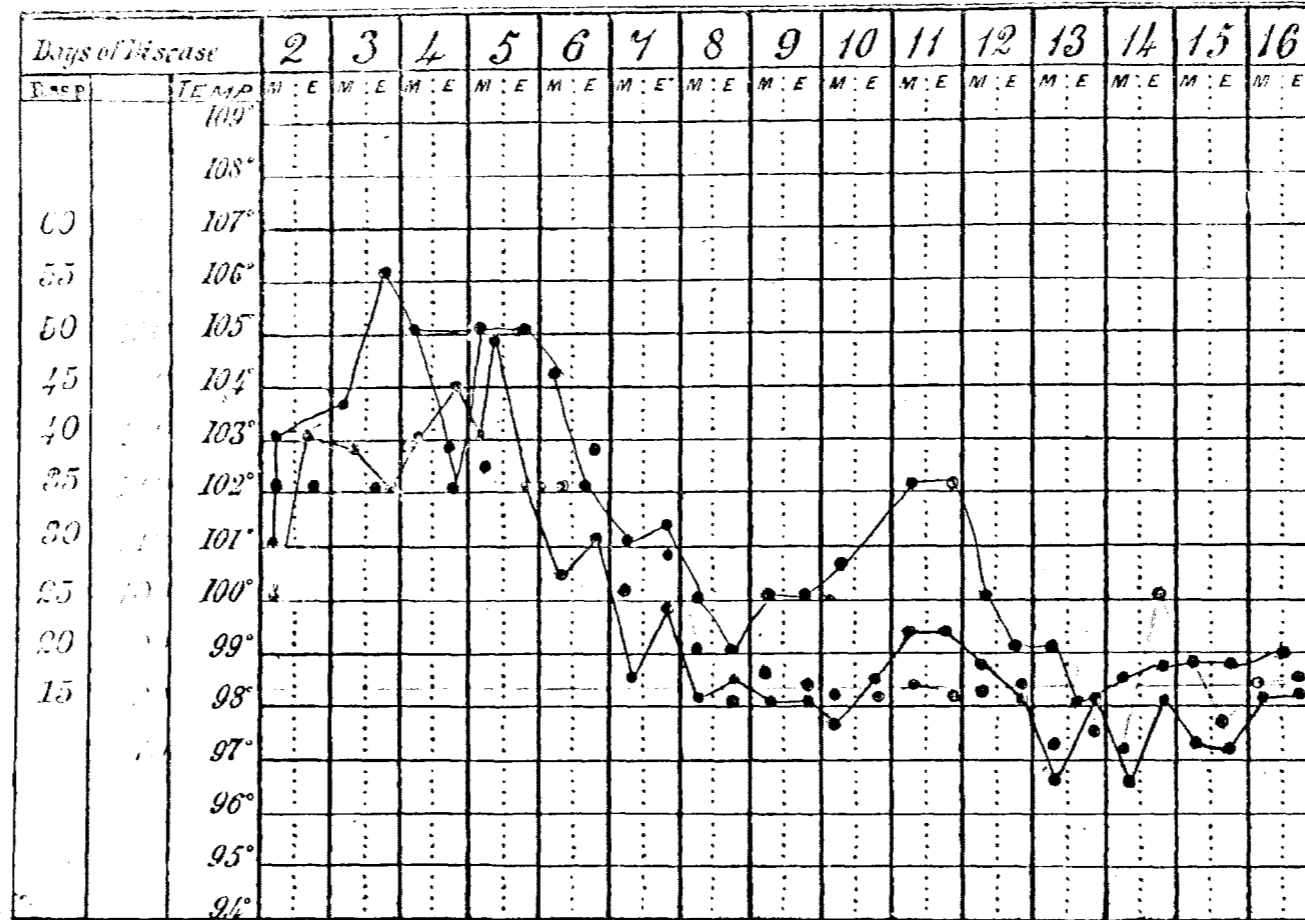


Chart of a case of simple bubonic plague, in which the bubo ended in resolution, showing the usual course of temperature, pulse and respiration. The temperature attained the maximum on the 5th day. The ratio between the temperature and respiration being abnormal through hypercemia of the lungs. The temperature reached to normal on the 8th day: the case was uncomplicated.

### CHART III.

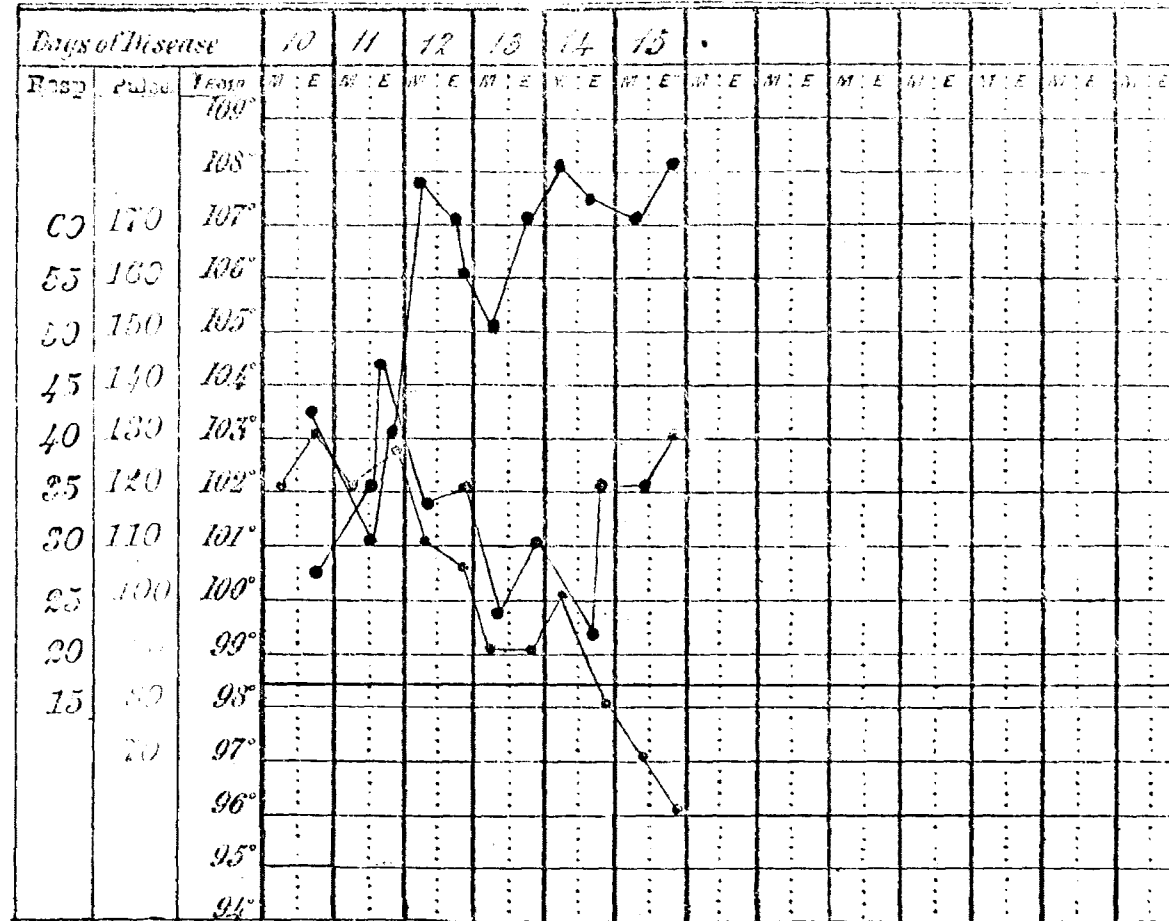


Chart of a case of simple bubonic plague with axillary bubo, and secondary pneumonia admitted on the 10th day of disease, and dying on the 15th

# CHART IV

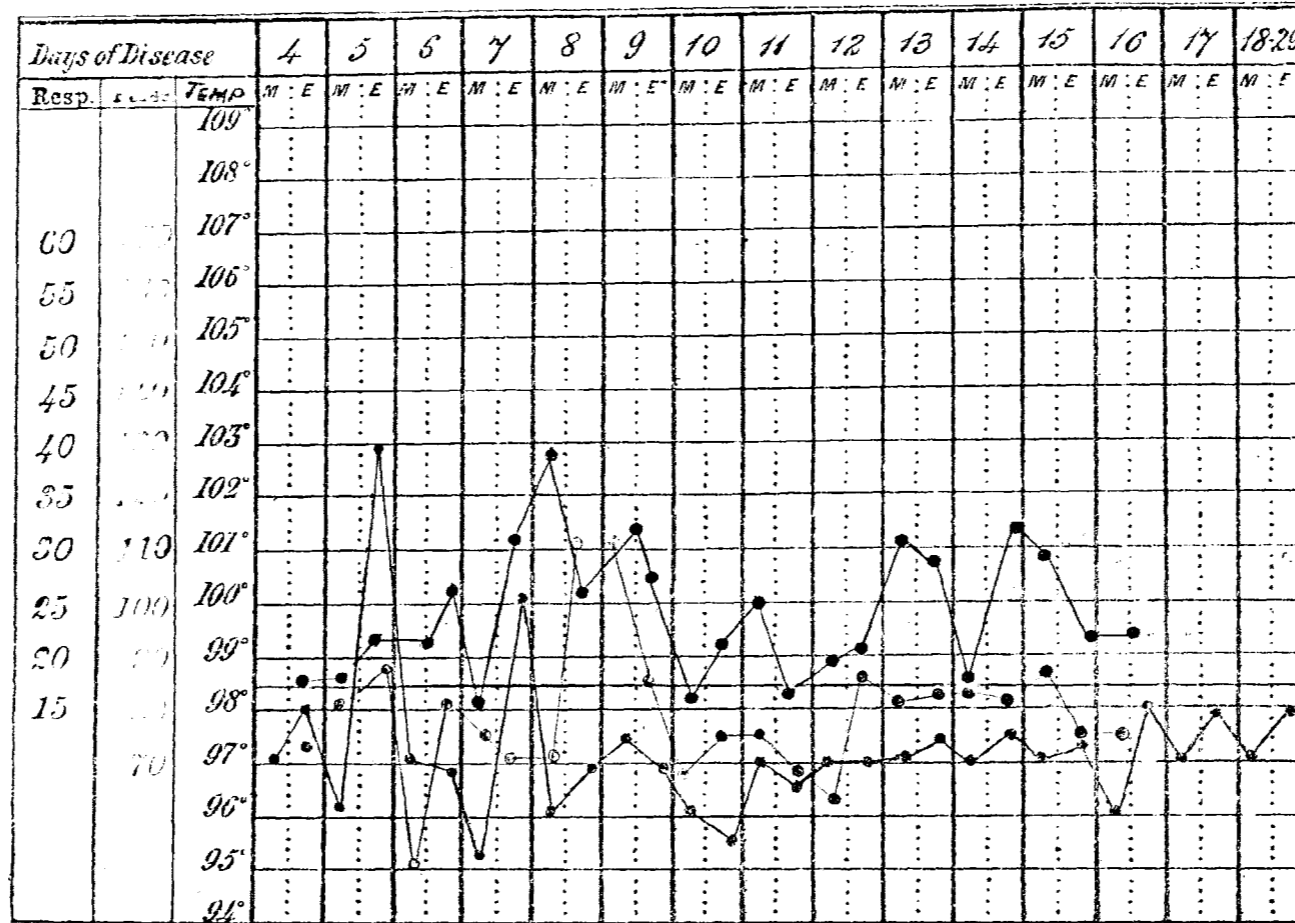


Chart of a case of bubonic plague, with inguinal bubo, complicated with secondary pneumonia, recovering on the 29th day. Temperature and pulse sub-normal, in marked contrast with respirations.

# Chart V

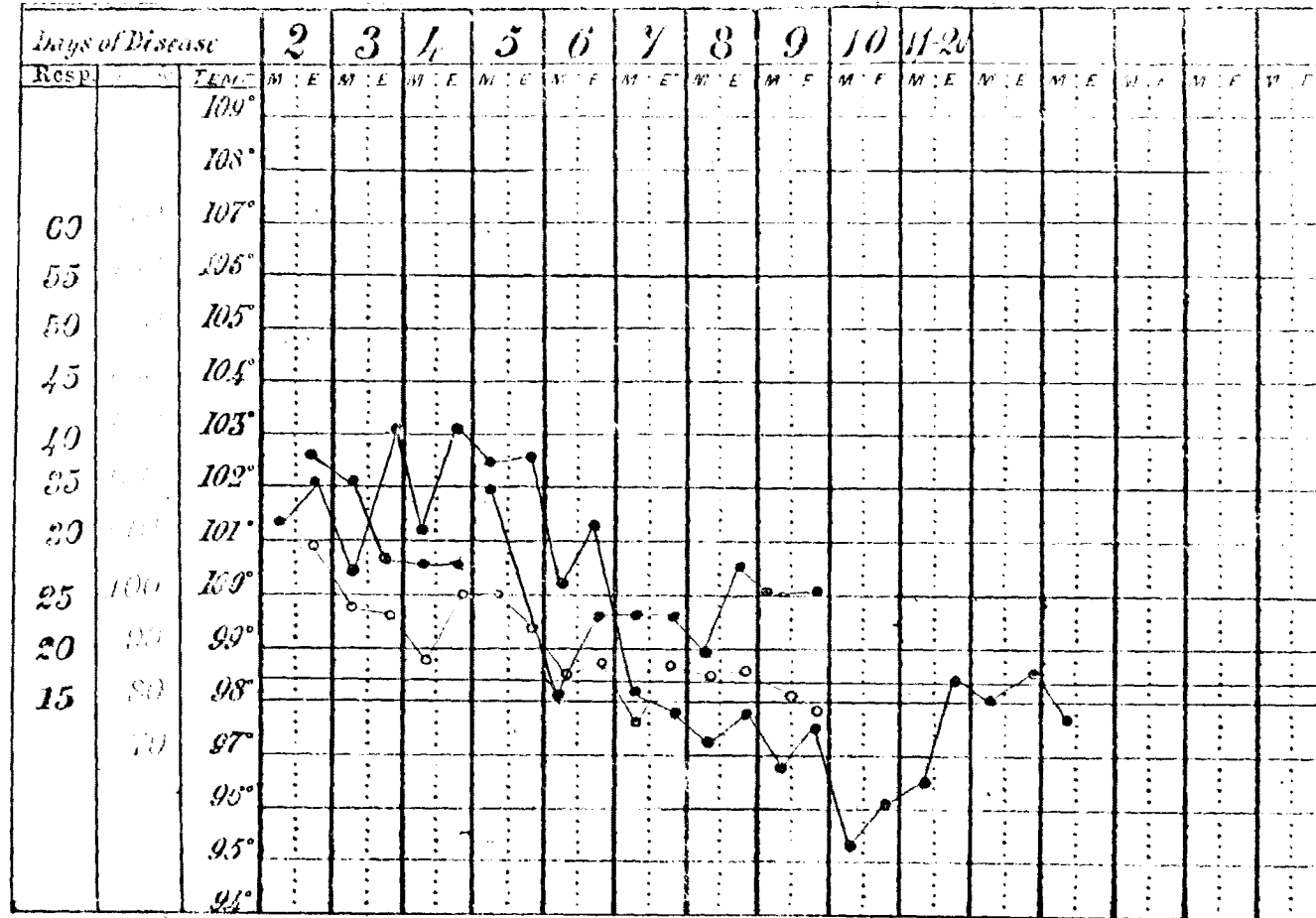


Chart of a case of simple bubonic plague with left inguinal, femoral and iliac buboes liq. iodi m. 20 was injected in the femoral bubo on the 5th day, as temperature persisted bubo resolved, and the patient recovered.

# CHART VI

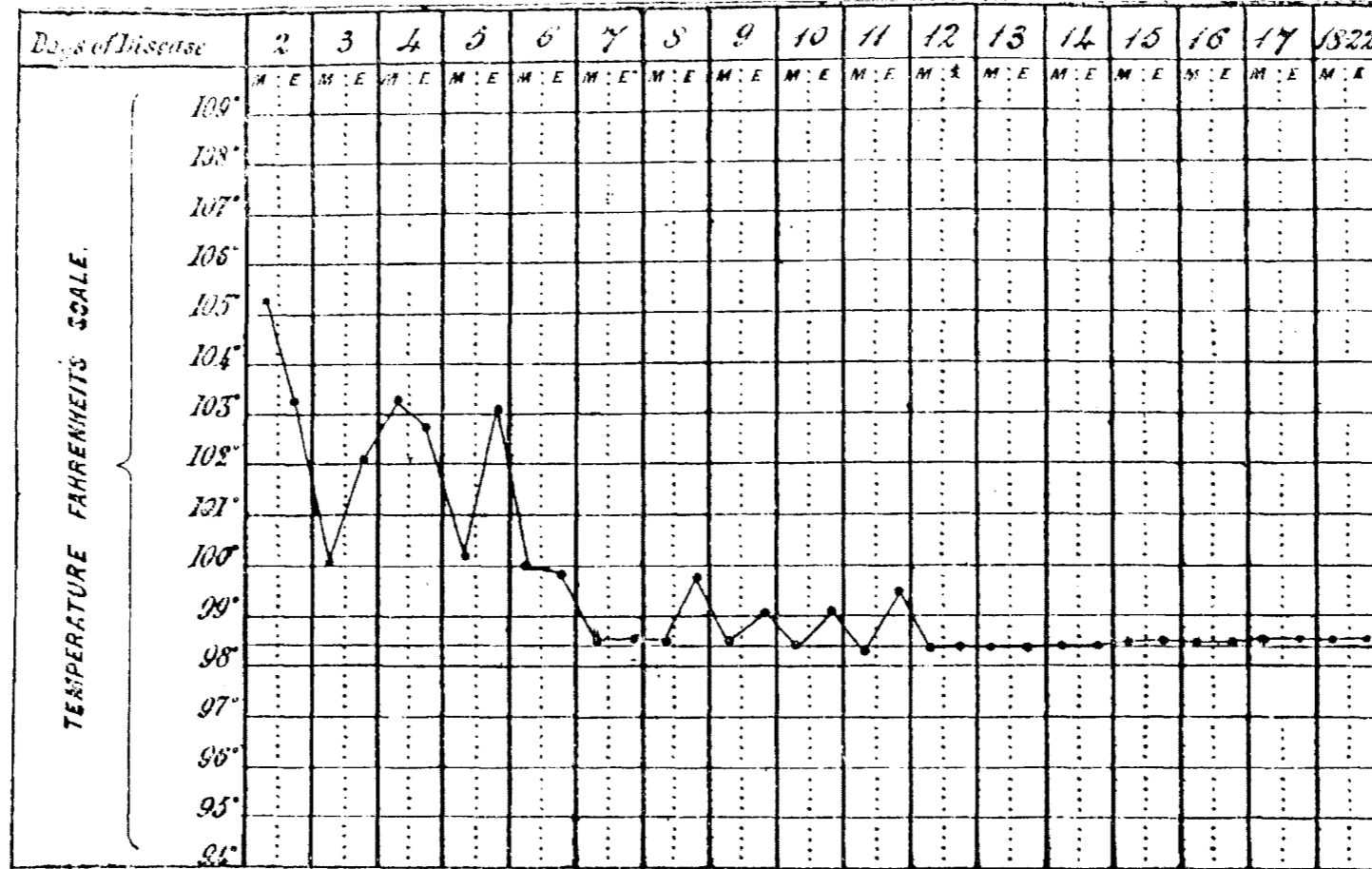


Chart of an infant aged about 2 years, with left femoro-inguinal bubo: extremely delirious and restless: was kept on mist. spirit. vin. gallici and intrieut enemata for over a month: bubo suppurated and the patient recovered.

# CHART VII

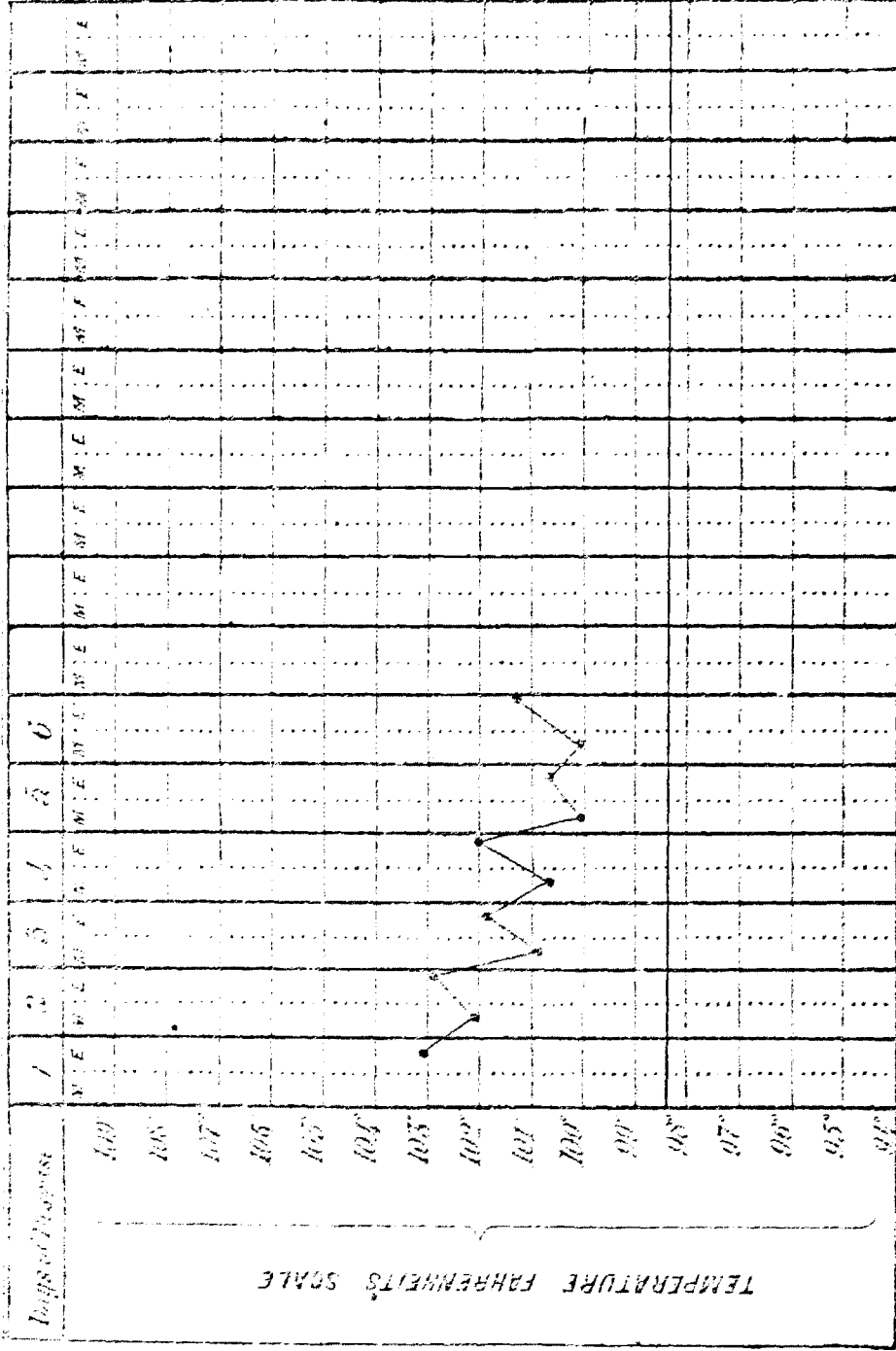


Chart of a case of simple bubonic plague with left inguinal and femoral buboes :  
 liq. Iodi m. 15 and Acid Carbolie m. 5 injected in the femoral bubo : death on  
 the 6th day of illness from gradual failure of heart's action.

# CHART VIII

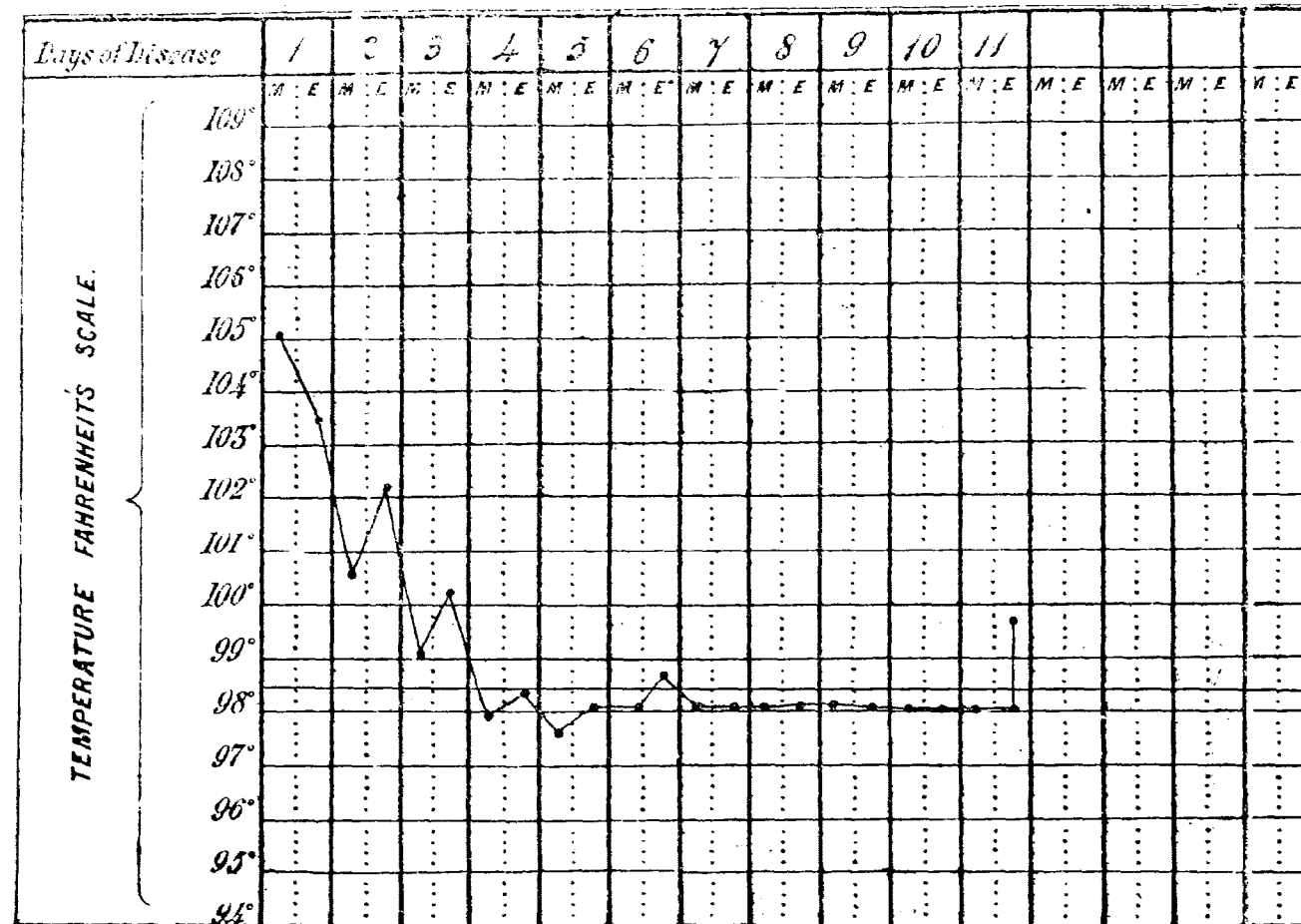


Chart of a case of simple bubonic plague with right femoral bubo. Temperature fell to normal on the 4th day, the patient dying on the 11th, from gradual failure of heart's action.

# CHART IX

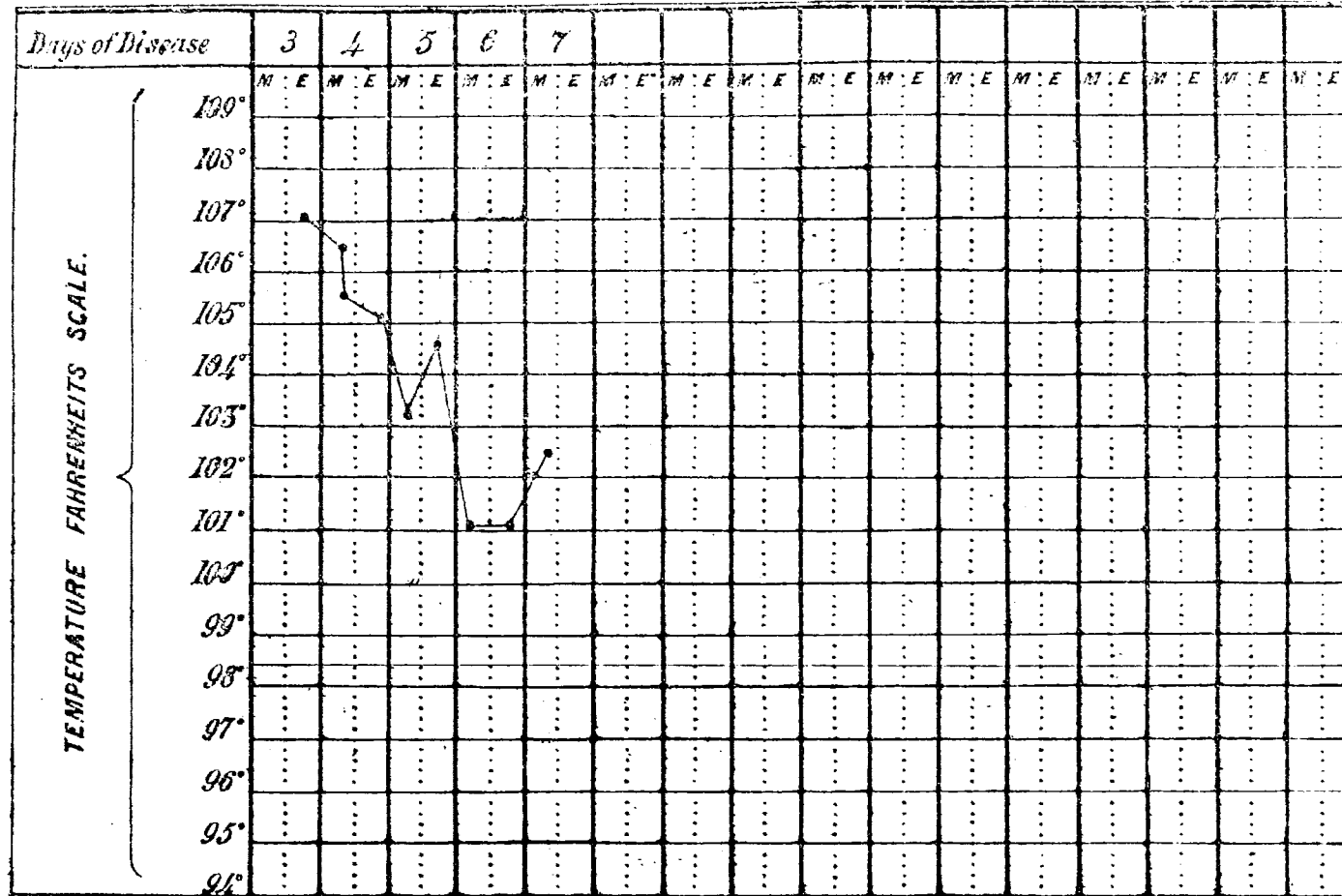


Chart of a case of simple bubonic plague registering a temperature of 107° 2 and proving fatal on the 7th day from heart failure, and cedema of lungs.



# CHART X

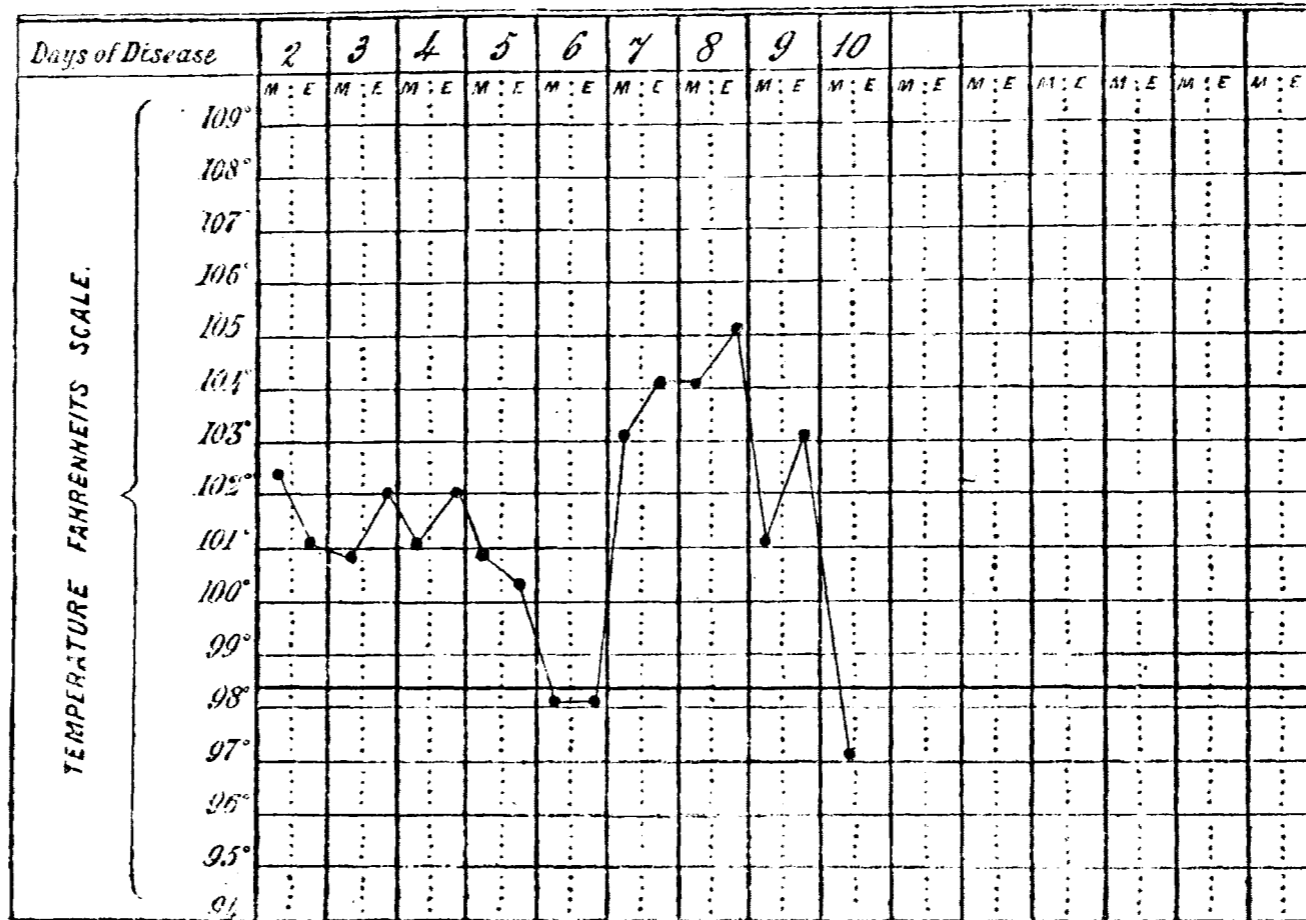


Chart of a case of simple uncomplicated bubonic plague, with double femoral buboes; Liq. Iodi and Acid Carbolici injected in both on the day of admissions right bubo suppurated and was incised on the 6th day of disease: The left showed signs of resolution. Deep pelvic buboes appeared, and the patient died on the 10th day of disease from failure of heart's action.

# CHART XI

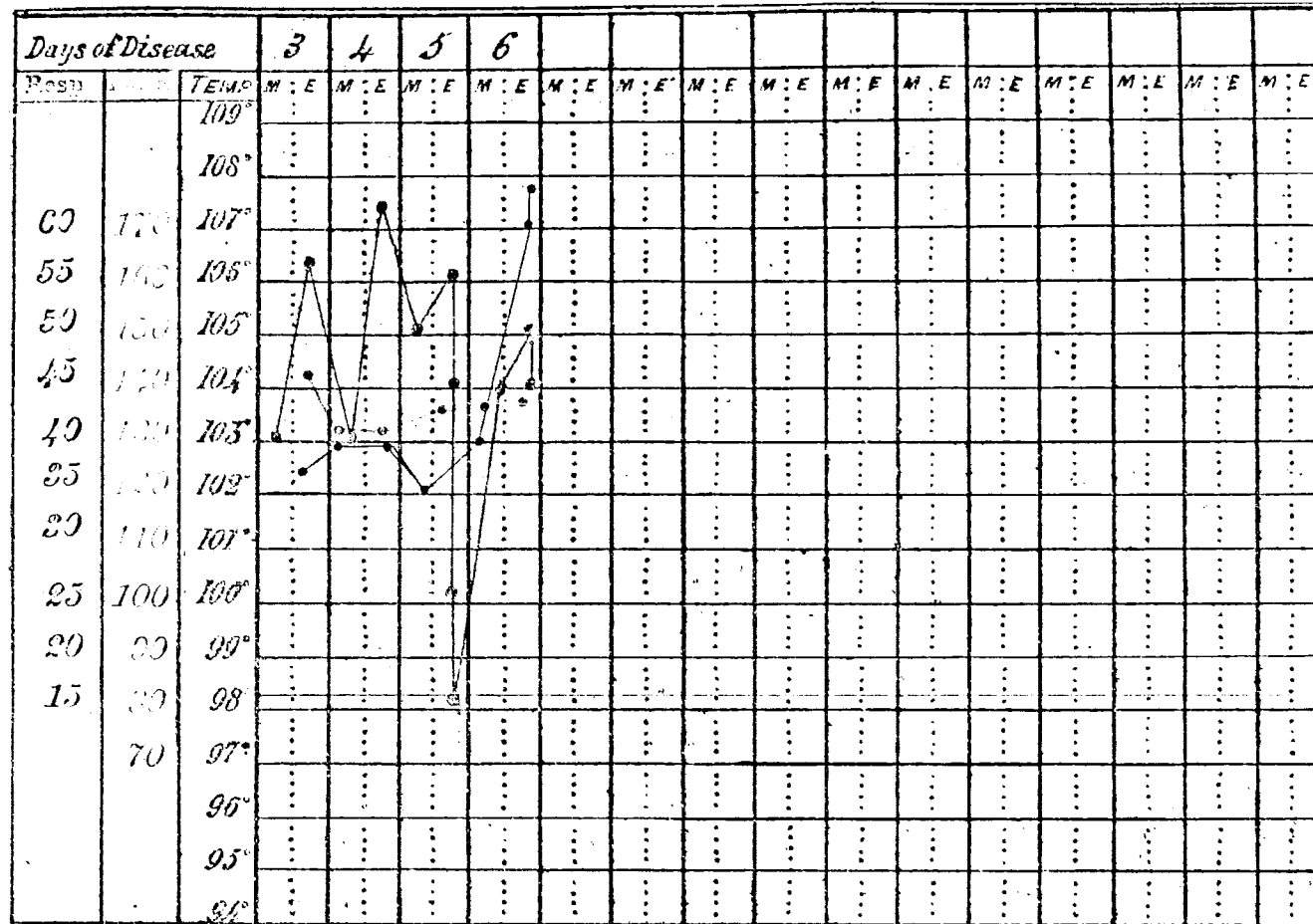


Chart of a case of plague of the septic type, with one inguino-femoral bubo. The patient was kept in wet pack for hours together: the maximum temperature registered was 107° 4: death from oedema of lungs.

# CHART XII

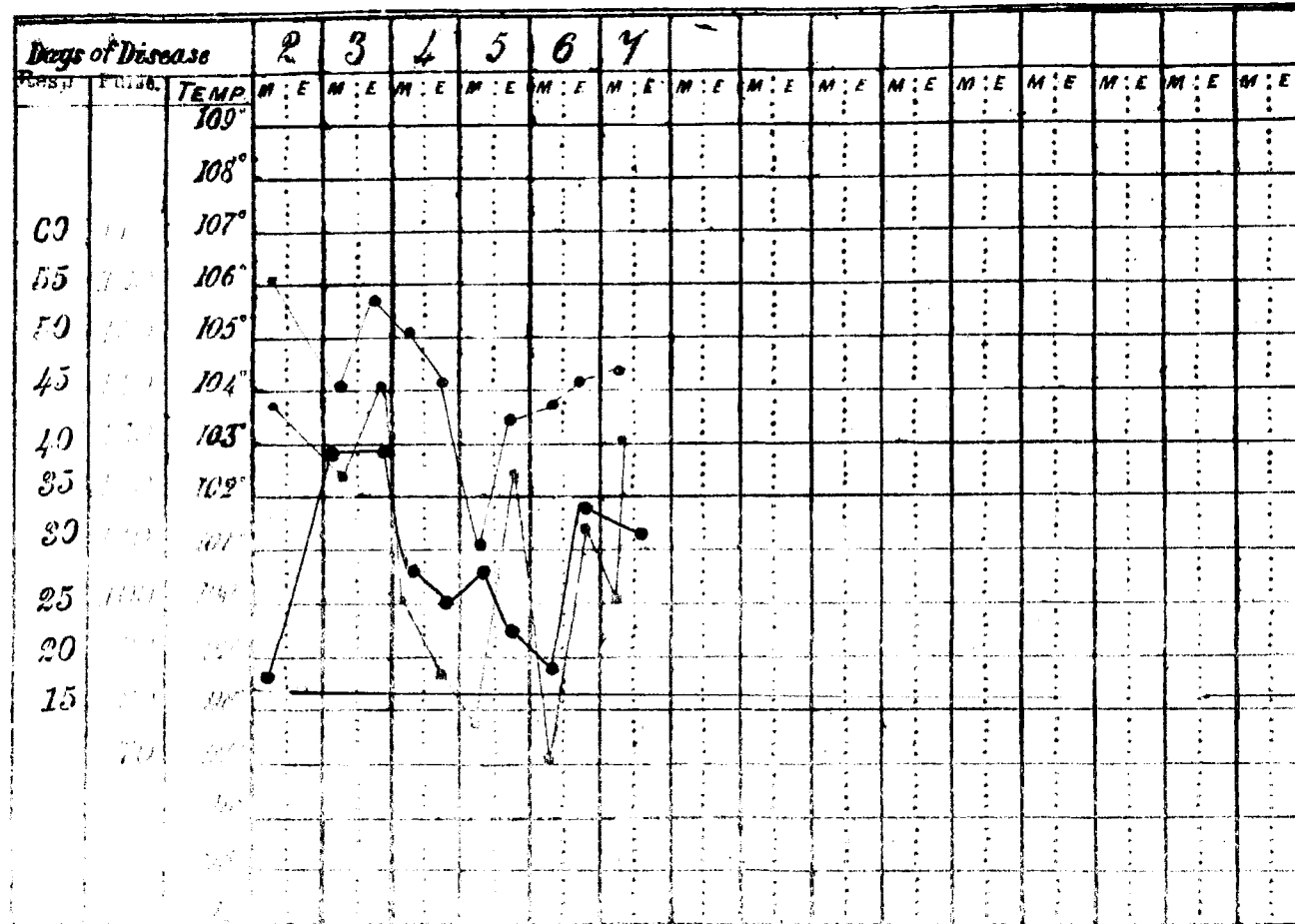


Chart of a fatal case of septic plague with axillary bubo, showing temperature pulse and respiration.

# CHART XIII

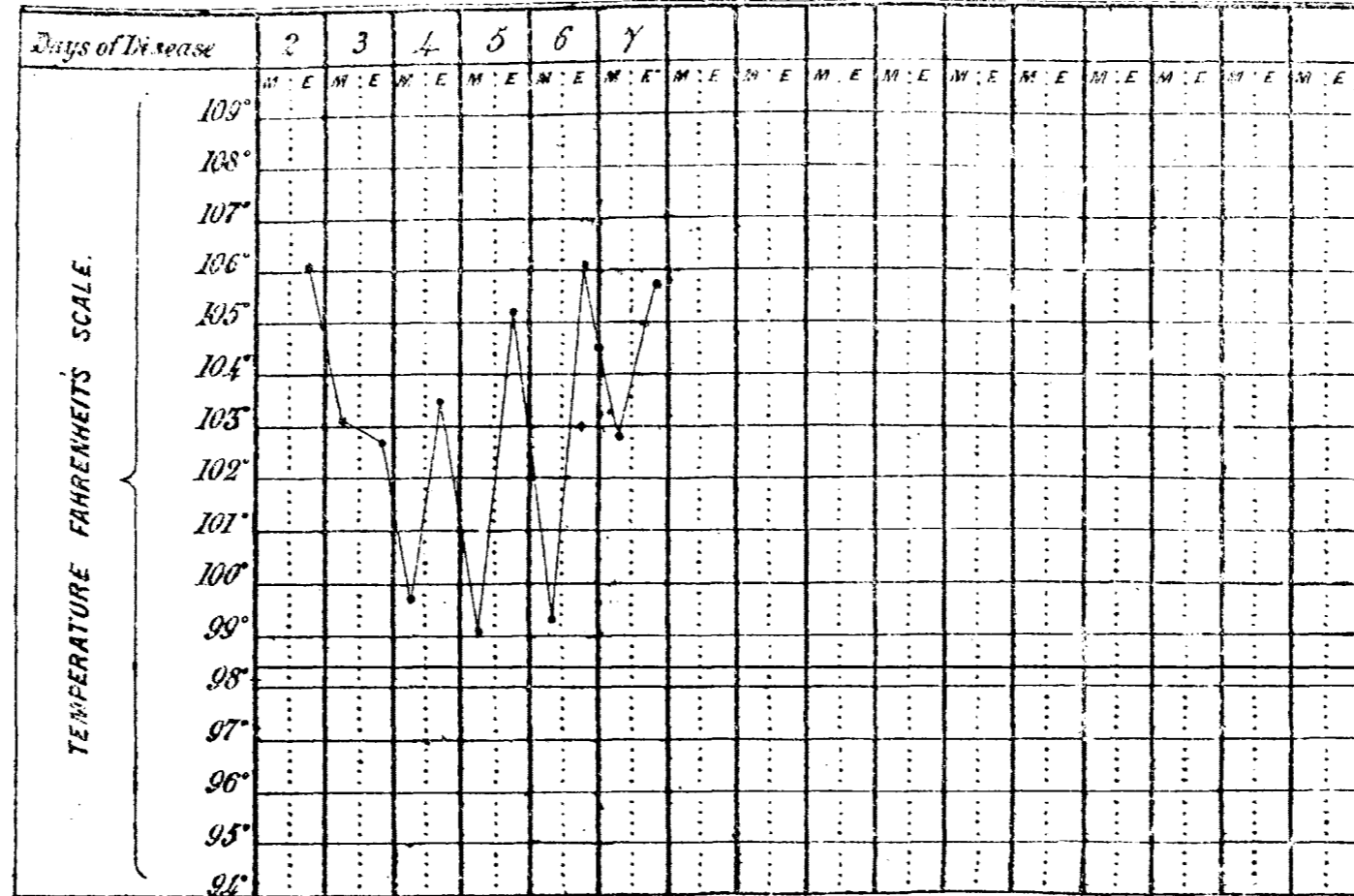


Chart of a case of the septic type of plague with double femoro-inguinal buboes: patient died from failure of heart's action during height of fever: The remissions in temperature are well marked: liq. Iodi m. 7 and Acid Carbolie m. 3 were injected on the evening of the 6th day of disease.

# CHART XIV

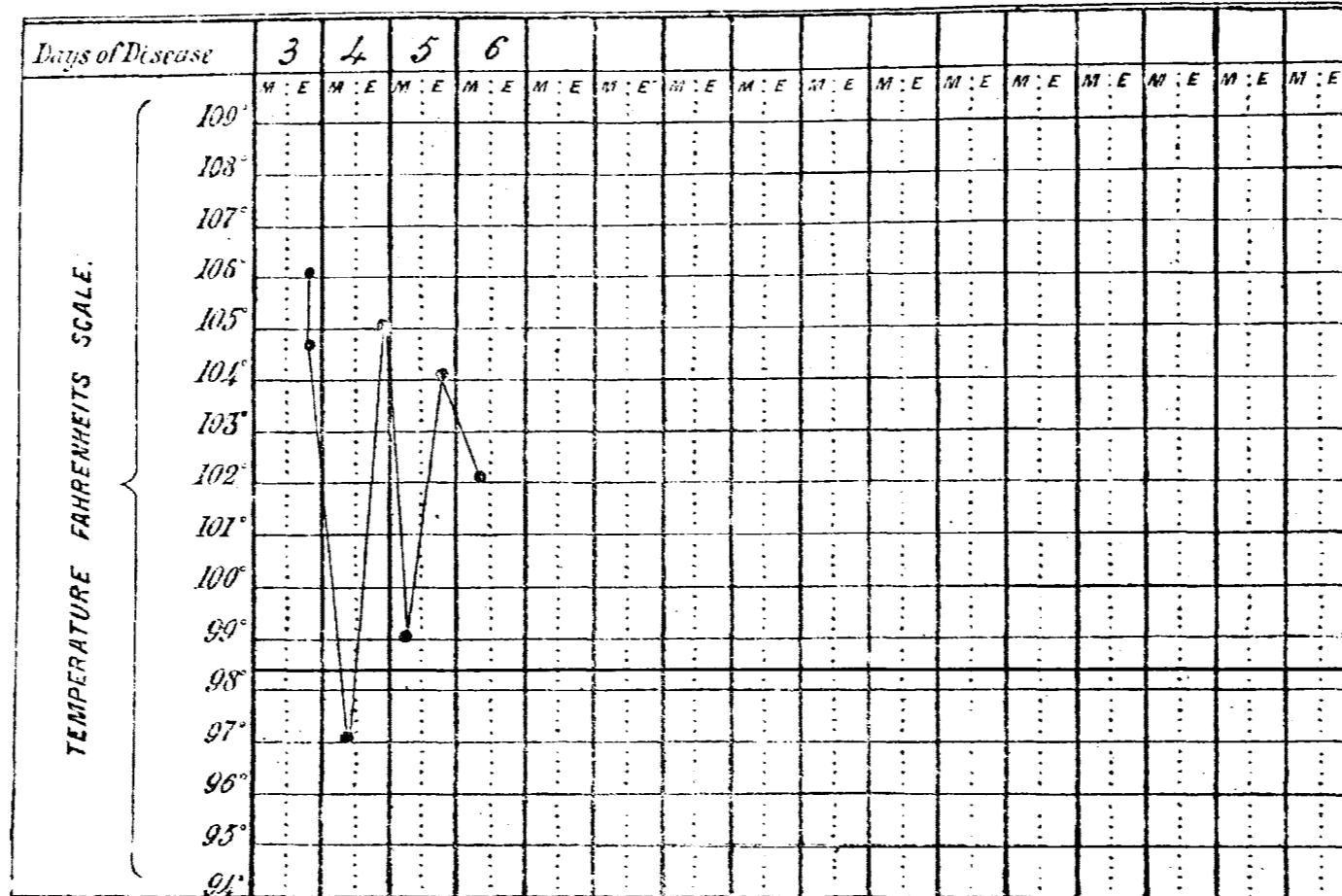


Chart of a case of septic, bubonic plague, with axillary bubo and infiltration: death from heart failure.

# CHART XV

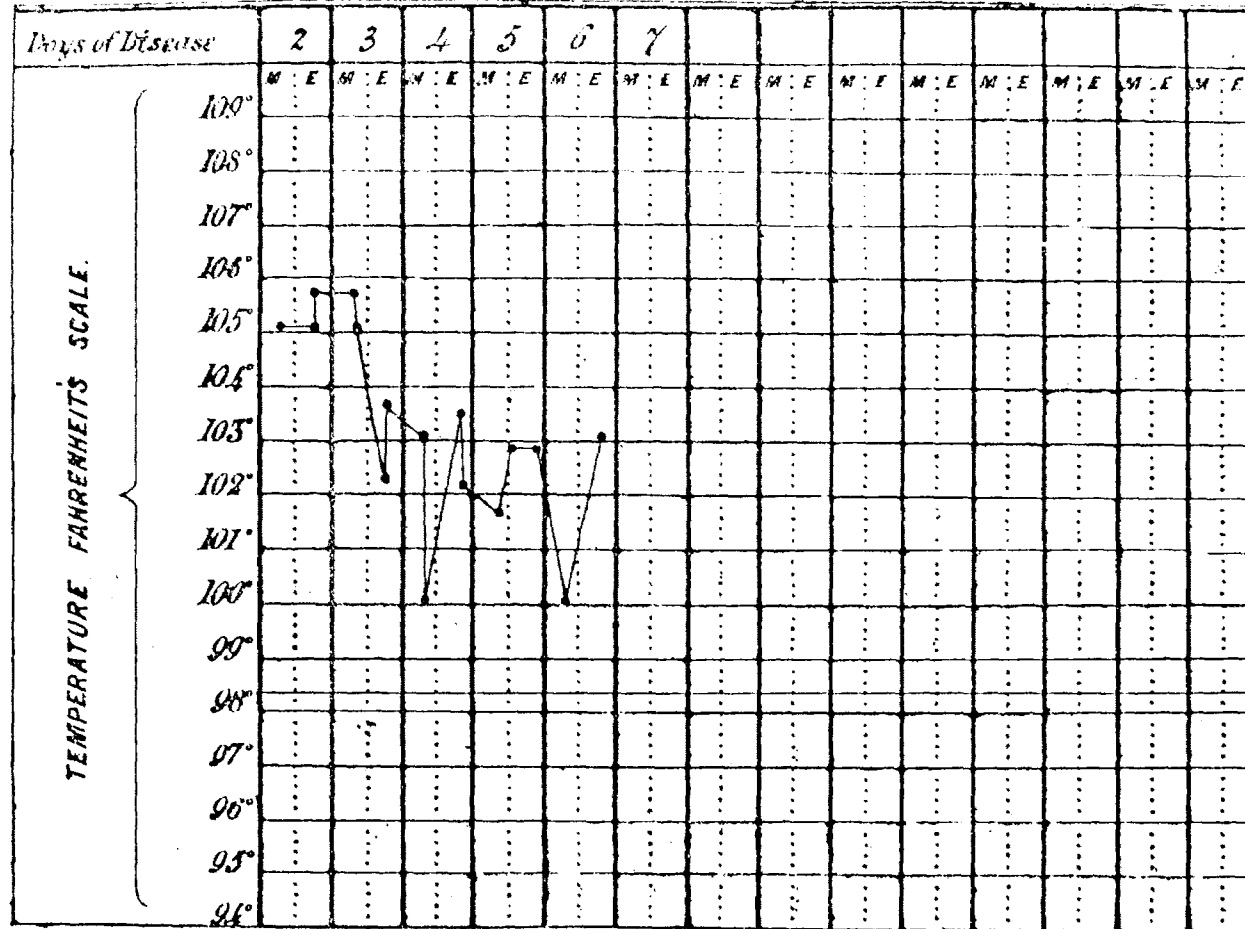


Chart of a case of septic plague, with femoro-inguinal buboes proving fatal on the 6th day; deep iliac bubo also appeared on the 5th day: liq. Ioid m. 20 was injected in the former; death from gradual heart failure.

# CHART XVI

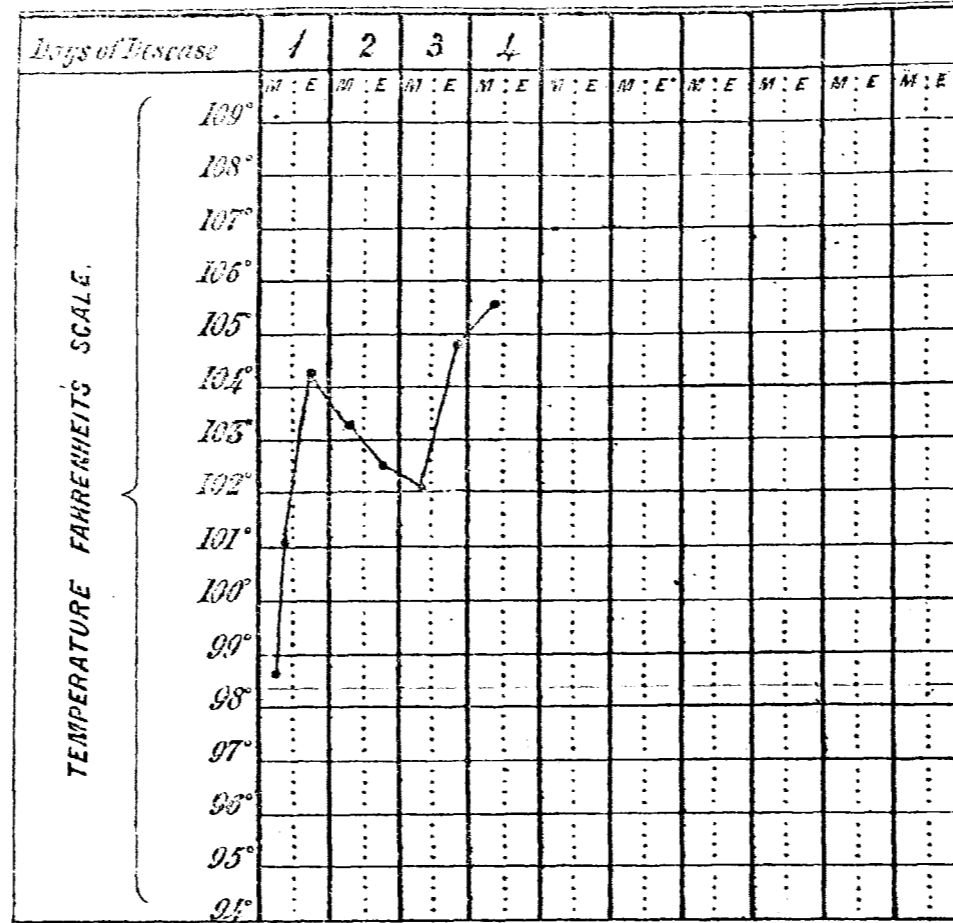


Chart of a child, aged 10, admitted within 12 hours of the first signs of illness. One of the worst cases observed: patient unconscious: Left cervical, parotid and axillary buboes with extensive infiltration, hard and stony extending from the sides of the cranium and occiput, to the left side of neck and face, and over the front part of chest as well as the left arm and forearm: death from œdema of glottis.

# REPORT

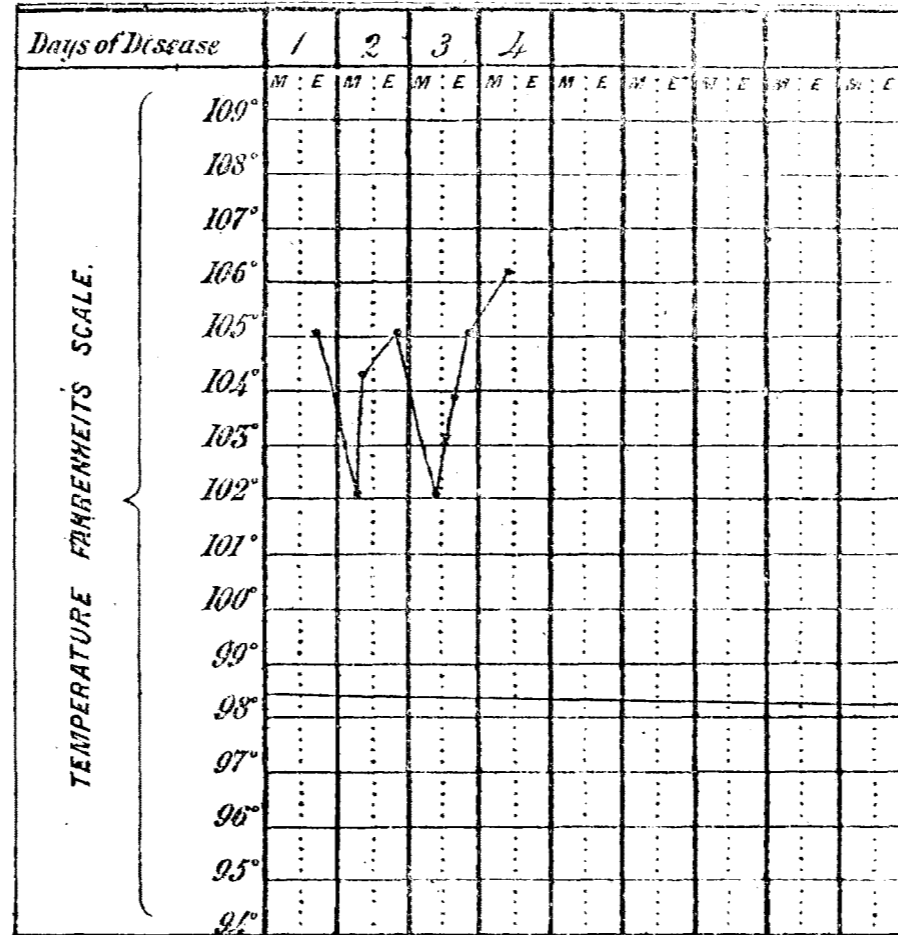


Chart illustrating the septic form of Plague. Patient, a Hindu lad, aged about 14; delirious and speechless on admission: Left Femoral, Right Inguinal and Right Pelvic buboes, extensive infiltration in the groins, extending into the scrotum. Patient died on the 4th day.



# CHART XVII

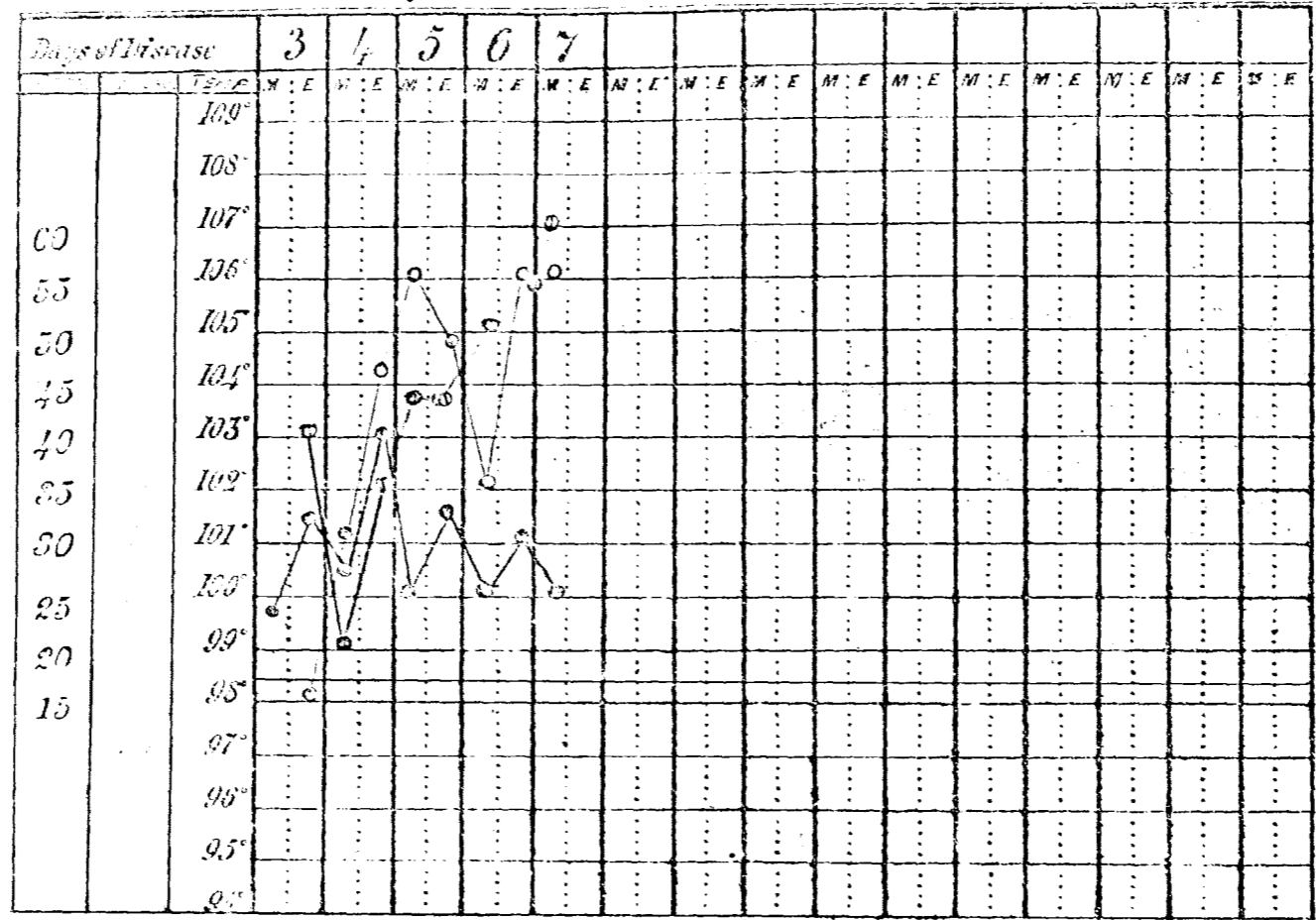


Chart of a case of the pneumonic type of plague, proving fatal on the 7th day, with secondary popliteal bube.

# CHART XIX

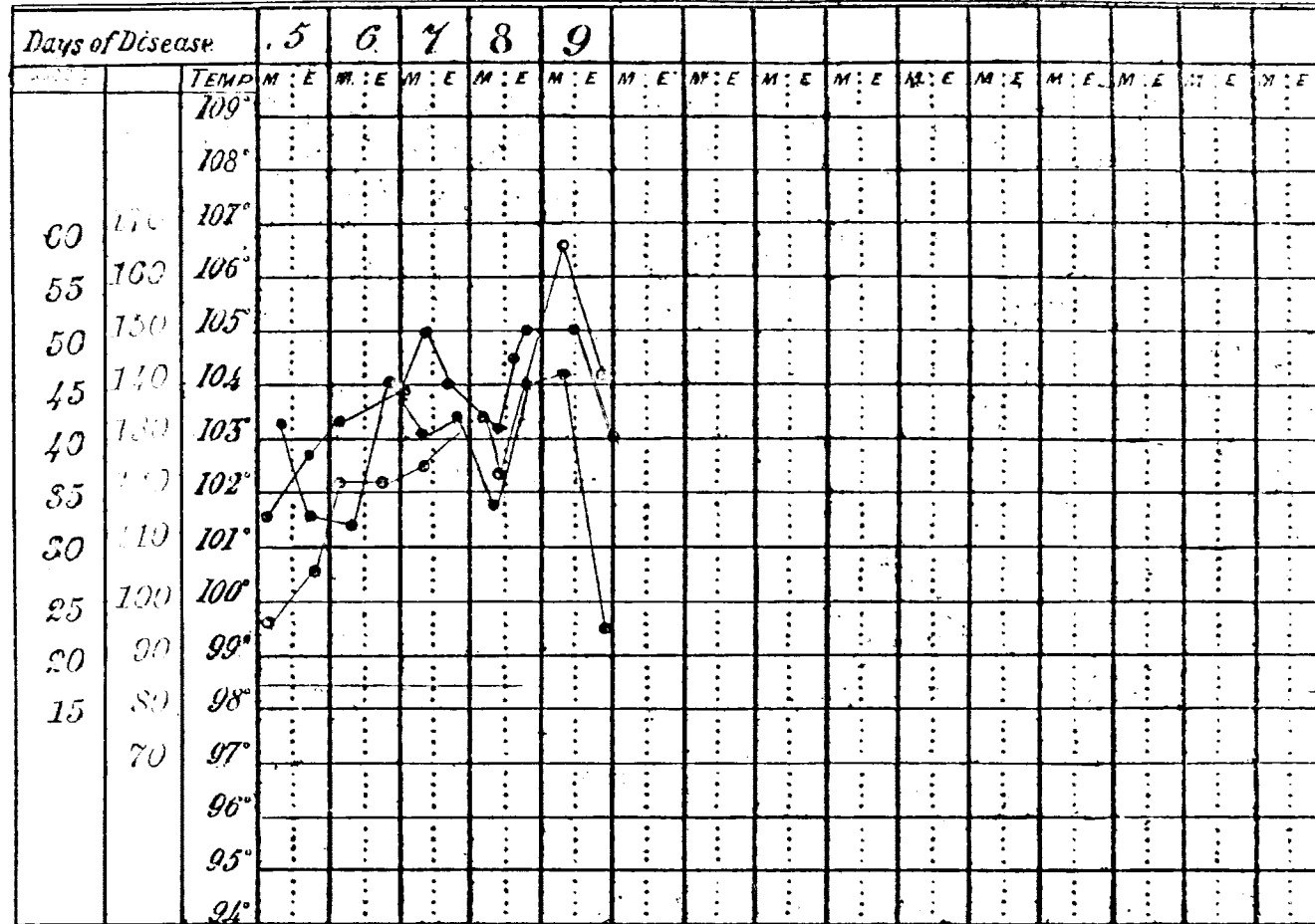


Chart of a case of plague of the pneumonic type, proving fatal on the 9th day, without buboes.

# CHART XX

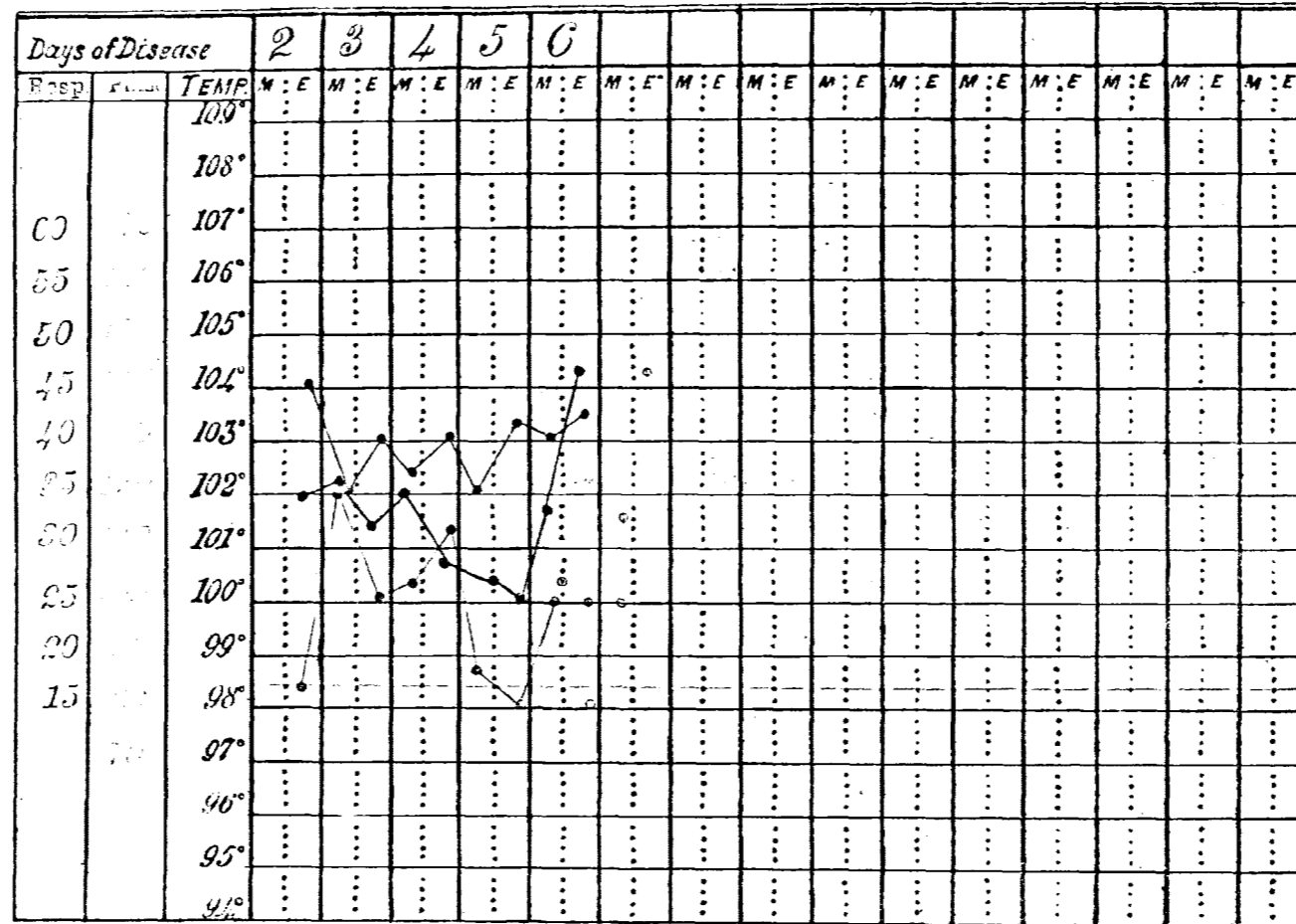


Chart of a fatal case of plague of the pneumonic type, without buboes.

# CHART XXI

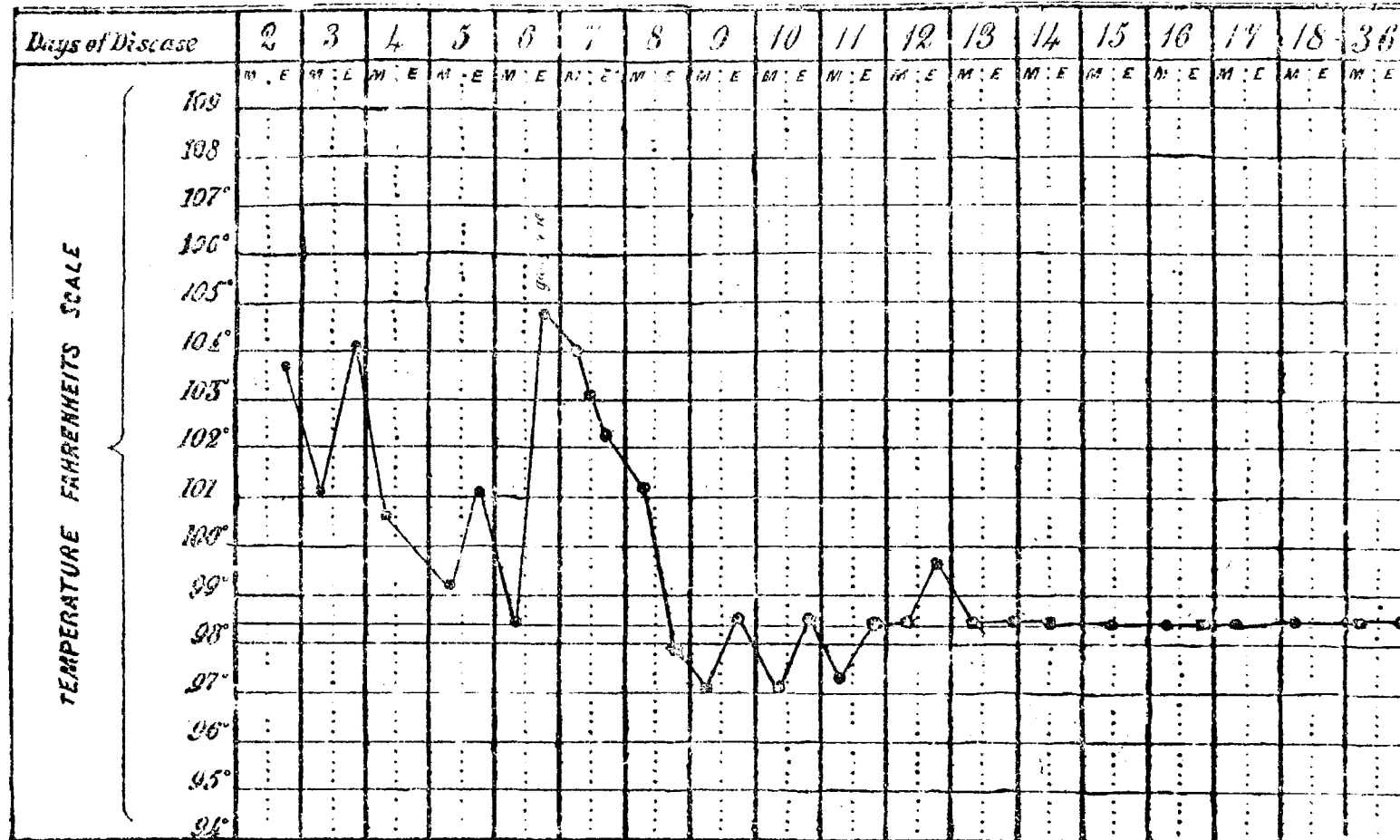


Chart illustrating a case of plague complicated with gangrene. Left femoral bubo, ended in resolution. Black boil at base of right thumb: gangrene supervened on the 6th day of disease extending up to middle of the arm: patient restless, and delirious; Corrosive sublimate 1/10th grain injected: fall of temperature and further progress checked. Patient made a good recovery and was discharged cured on the 36th day.

## CHART XVII

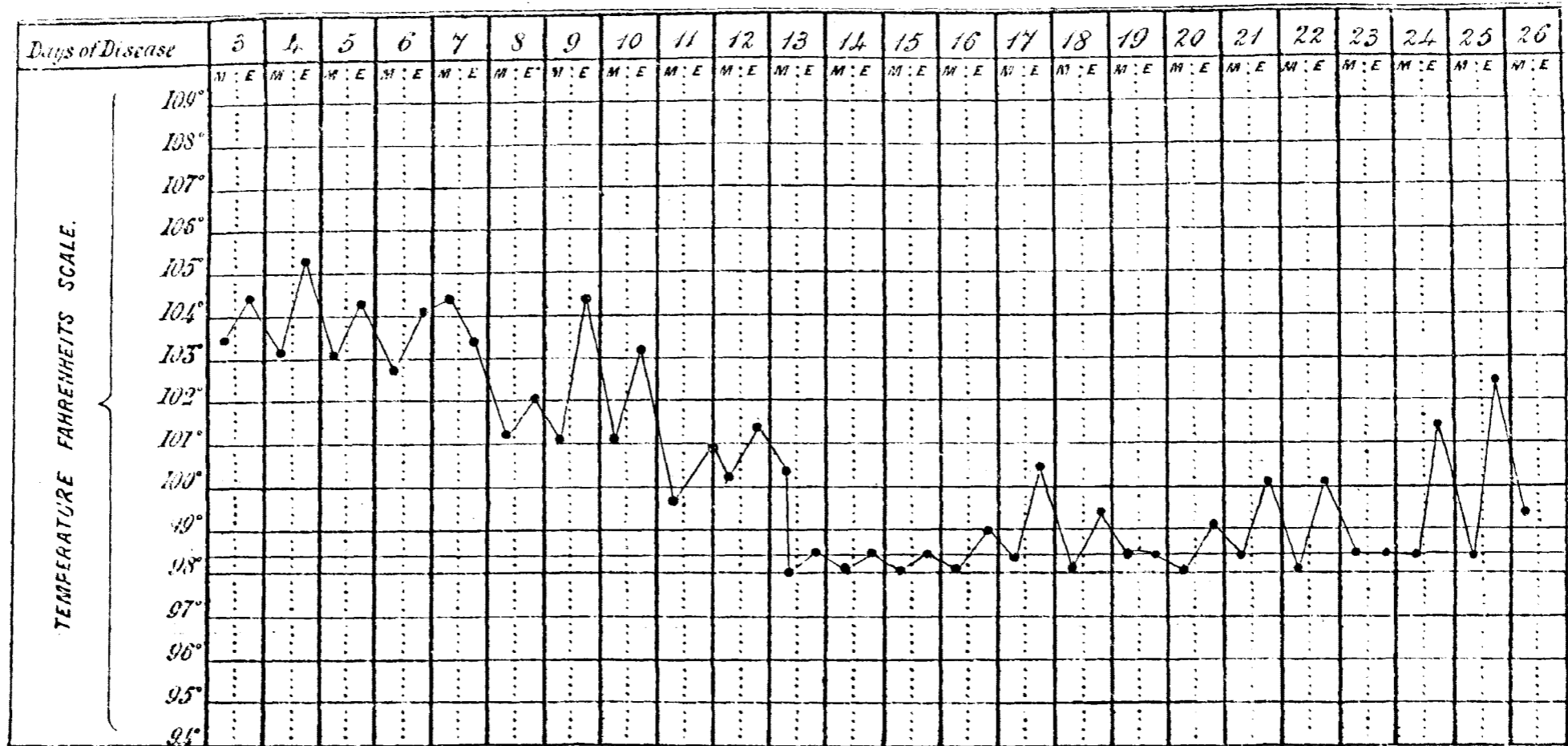


Chart illustrating a plague case, complicated with gangrene of foot and leg. Buboes—left femoral and inguinal. Blister on dorsum of foot near base of toes. Buboes injected with Iodine, suppurated and incised. Gangrene supervened on the 9th day of illness; Corrosive Sublimatē 10 grain injected just above the knee; further progress of gangrene checked; death on the 26th day from œdema of lungs, diarrhœa and exhaustion.

# CHART XXIII

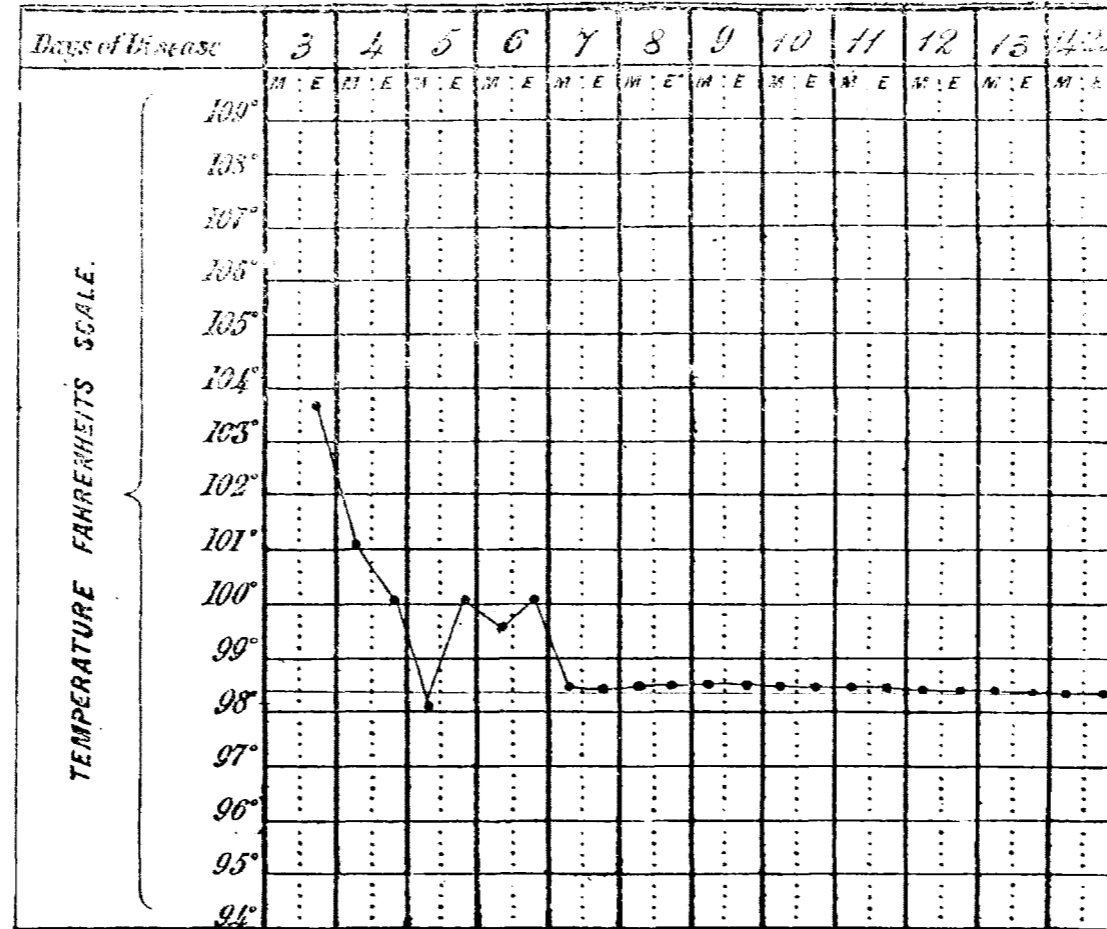


Chart to illustrate the action of intraglandular injections: patient, age 25, with 3 buboes, femoro-inguinal: injection of liquor Iodi m. 10: fall of temperature and resolution of buboes.

# CHART XXIII

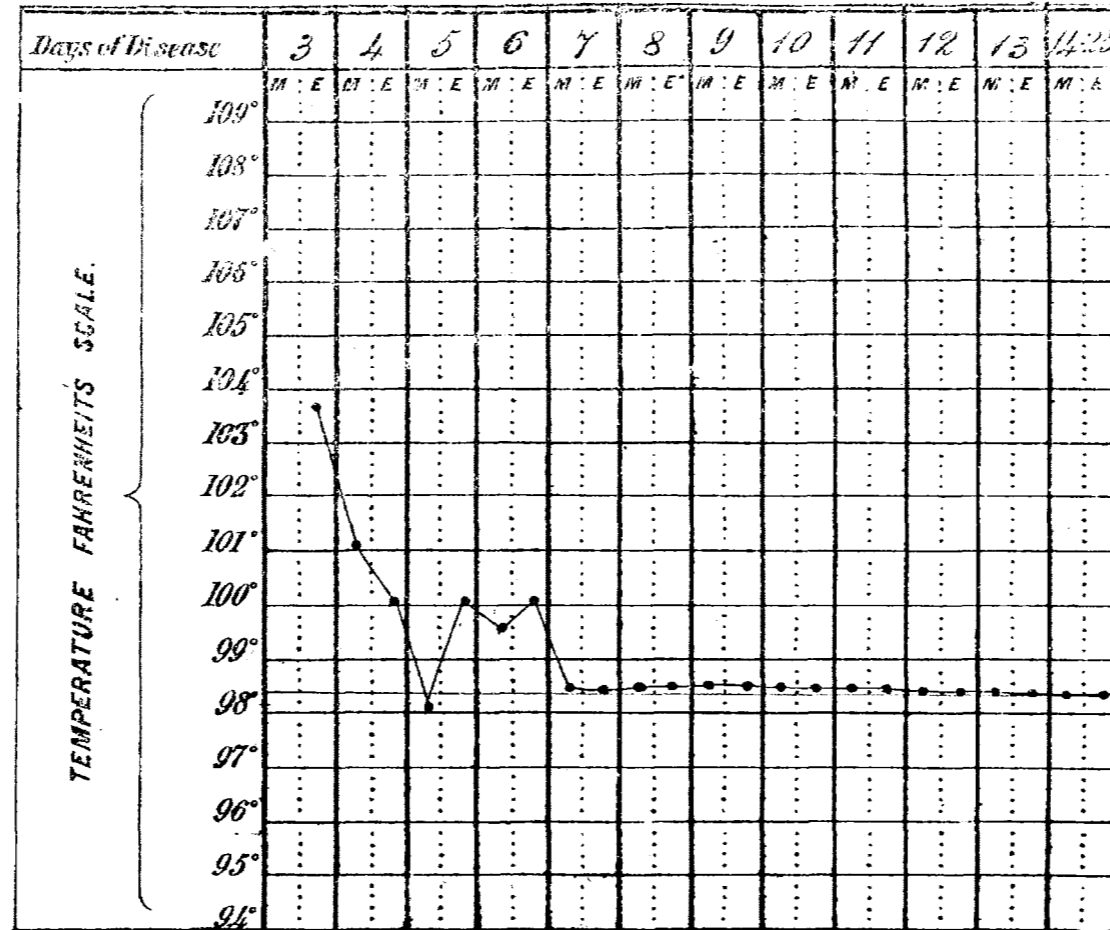


Chart to illustrate the action of intraglandular injections: patient, age 25, with 3 buboes, femoro-inguinal: injection of liquor Iodi m. 10 : fall of temperature and resolution of buboes.

## CHART XXIV

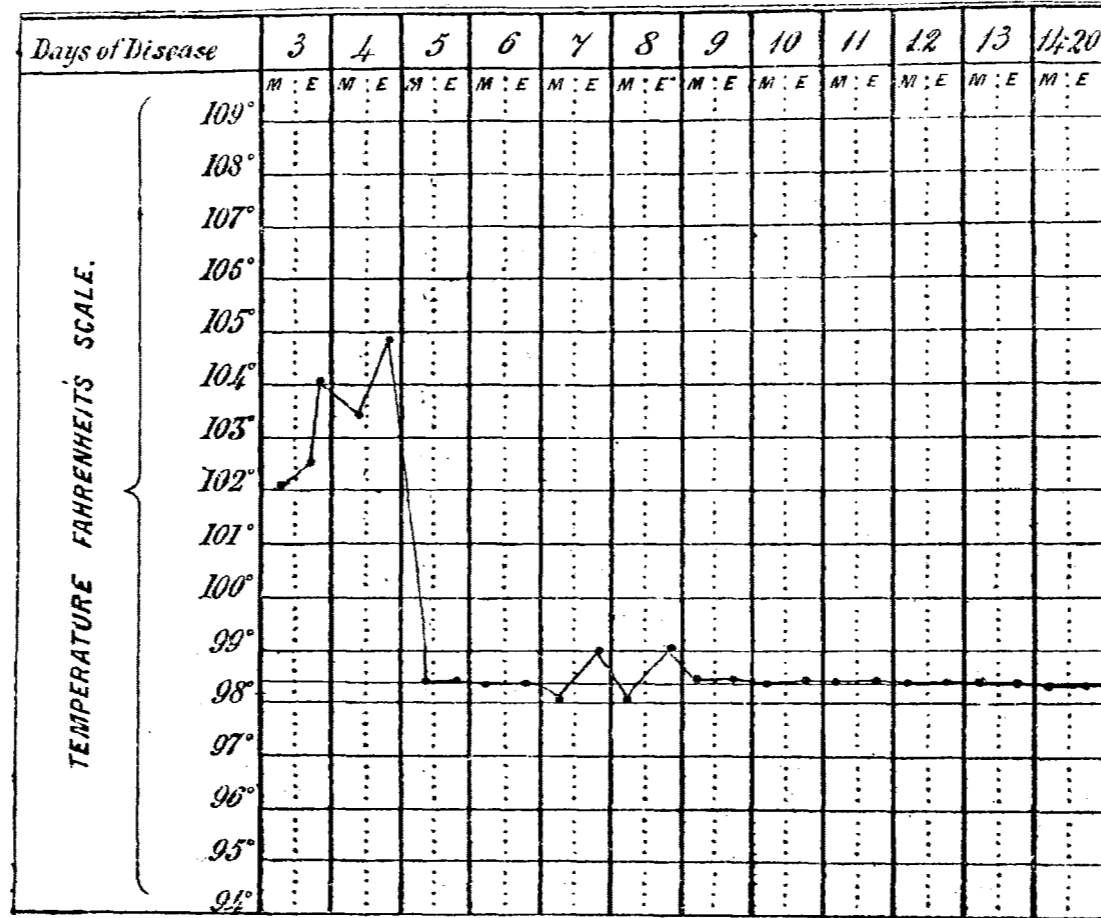


Chart of a Mahomedan lad, aged 14 : unconscious on admission and remaining so till the temperature fell to normal : double inguinal buboes ; both injected with iodine on the 4th day ; the temperature fell to normal on the 5th : both the glands resolved, the patient making a good recovery. The chart well illustrates the action of Iodine intraglandular injections.



# CASE XXV

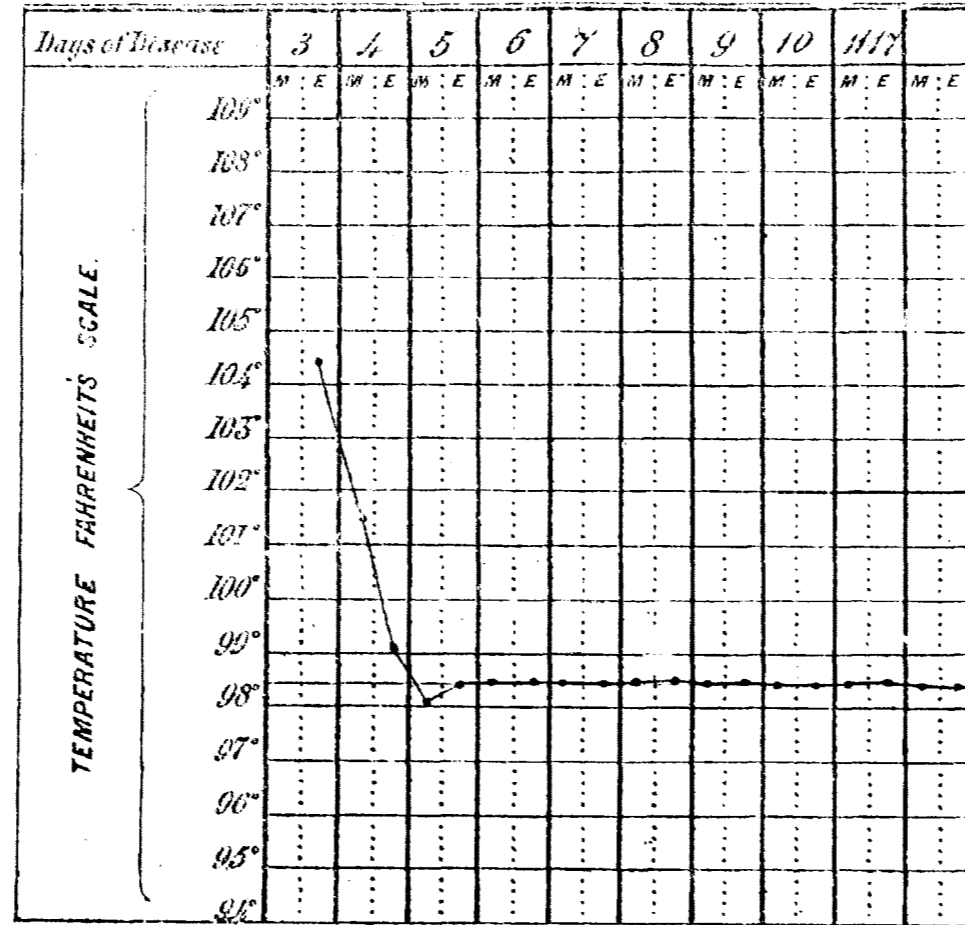


Chart to illustrate the action of intraglandular injections: Patient aged 12, with left axillary bubo; Jeys' Liq. Antisepticus (Refined Creolin) m. 10 was injected; steady fall of temperature, resolution of bubo and recovery.

# CHART XXVI

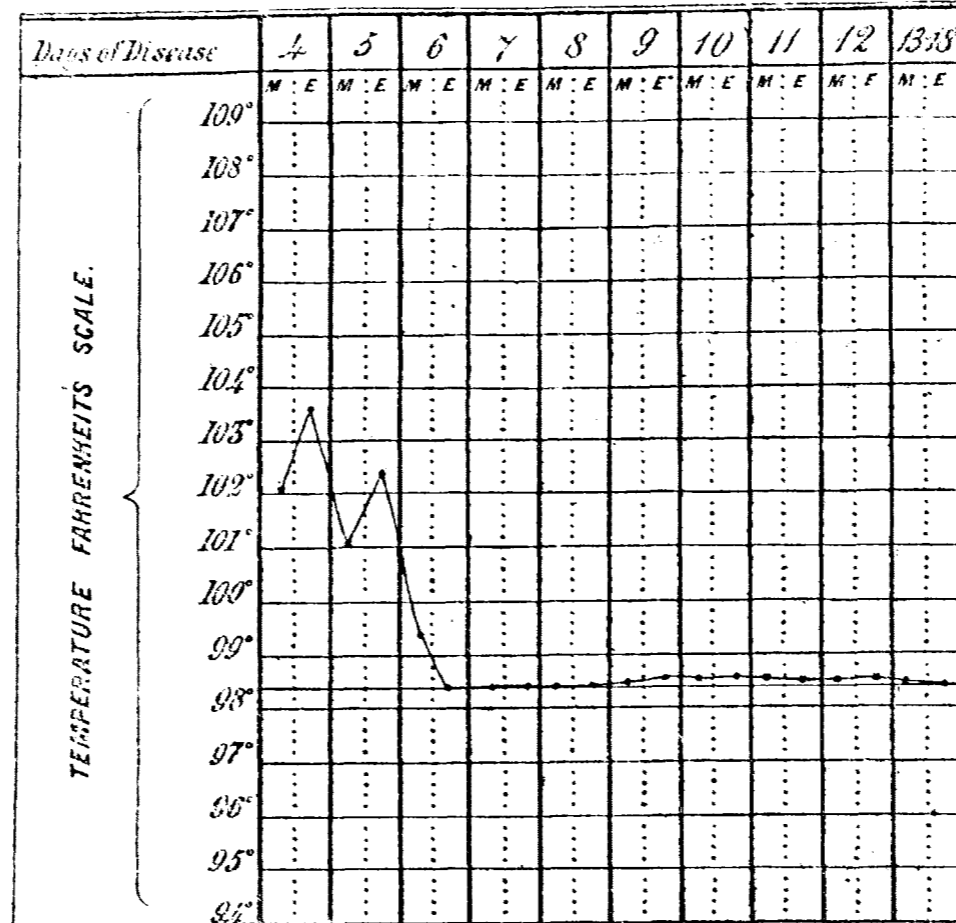


Chart to illustrate effects of intraglandular injections: Patient aged 25 : left axillary bubo, was injected with liq. Iodi ms. 10 and Acid Carbolie ms. 3: bubo suppurated and was incised on the 7th day : recovery.

# CHART XXVII

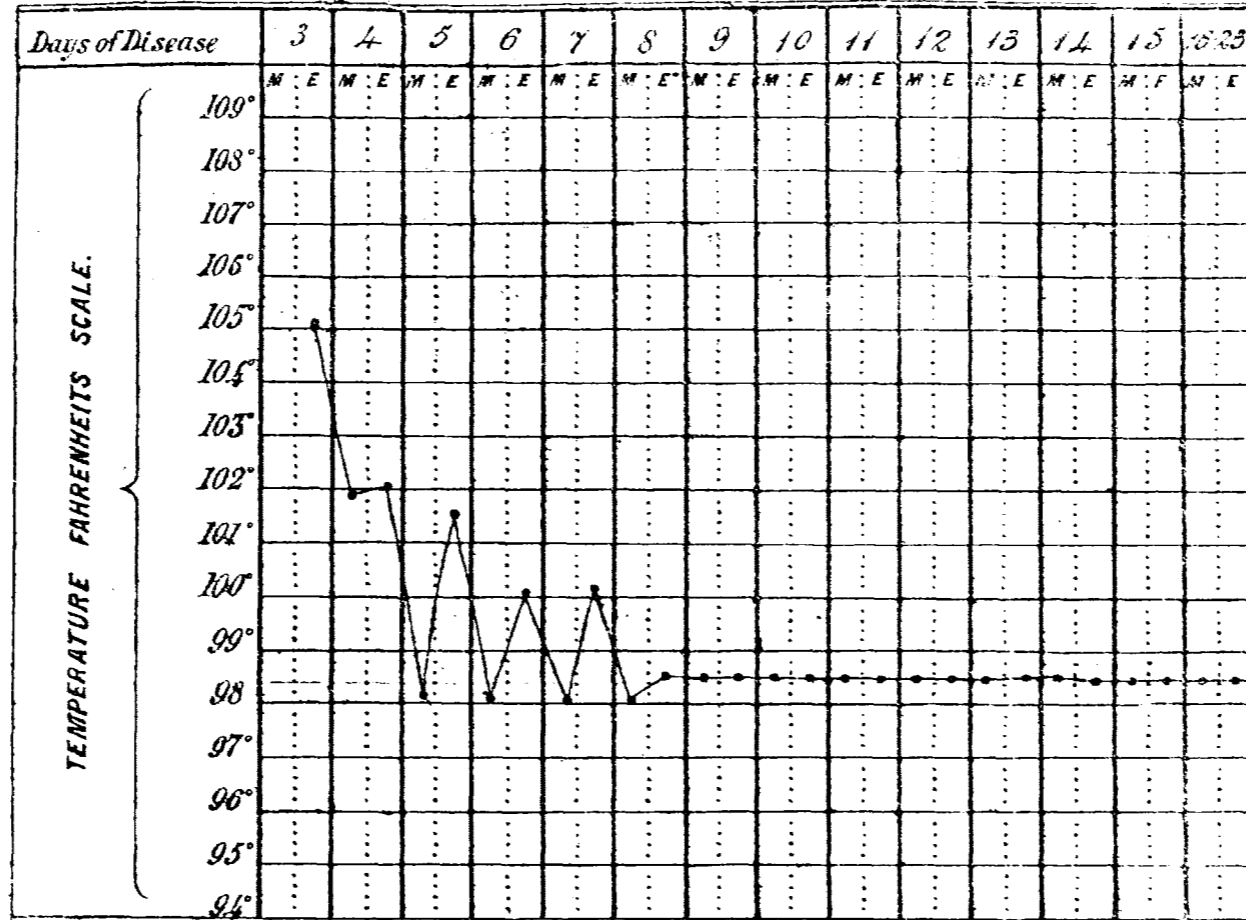


Chart to illustrate action of intraglandular injections: patient, age 22; left inguinal bubo: liq. iodi m. 20 injected; fall of temperature: bubo suppurated and was incised on the 11th day of disease: recovery.

# CHART XXVIII

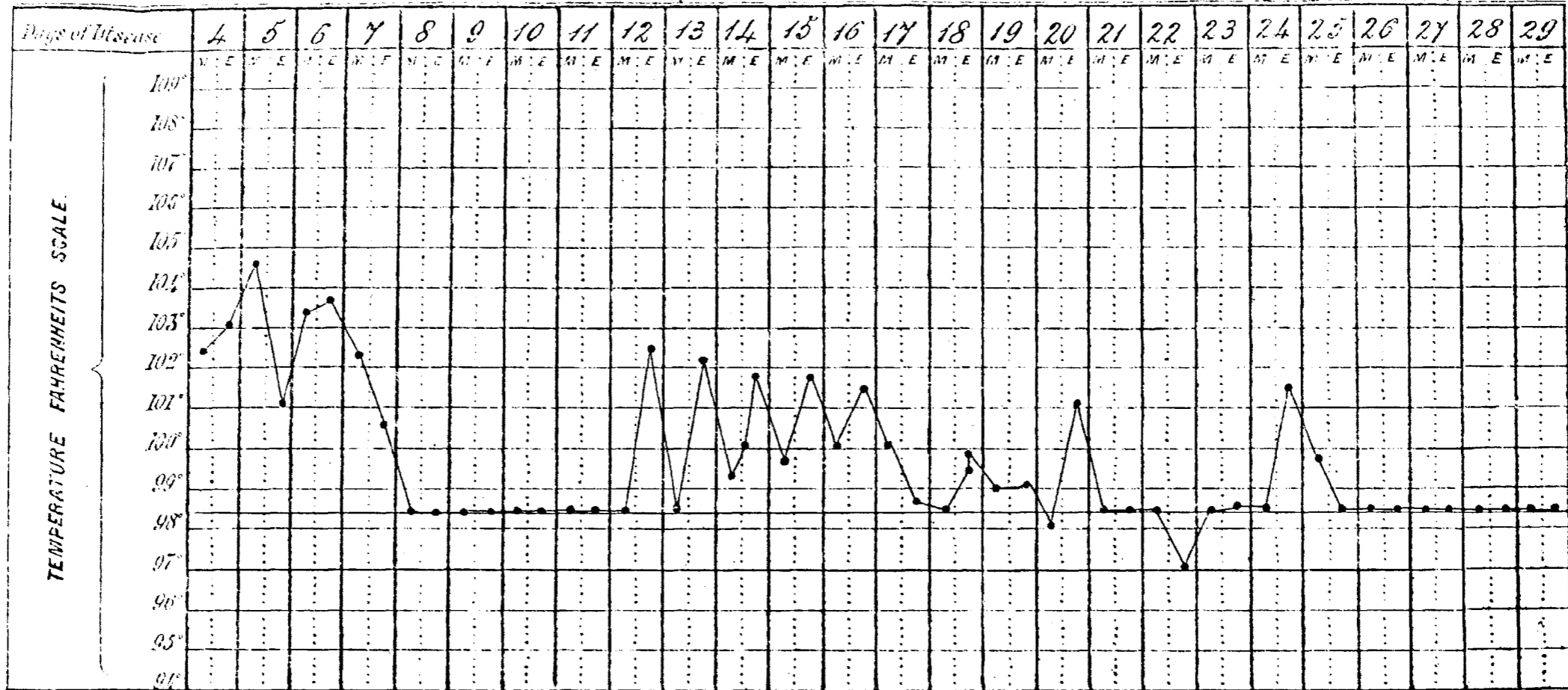


Chart of a young Hindoo girl, aged about 15 years: left femoral bubo,—injected with liq. iodi, suppurated and incised: fall of temperature to normal on the 8th day with suppuration. On the 12th day, temperature again rose on account of a large bubo appearing in the pelvis, above the Poupart's ligament: it subsided very very gradually on account of the patient not keeping up constant poulticing: it resolved ultimately the patient making a good recovery.

# CHART XXIX

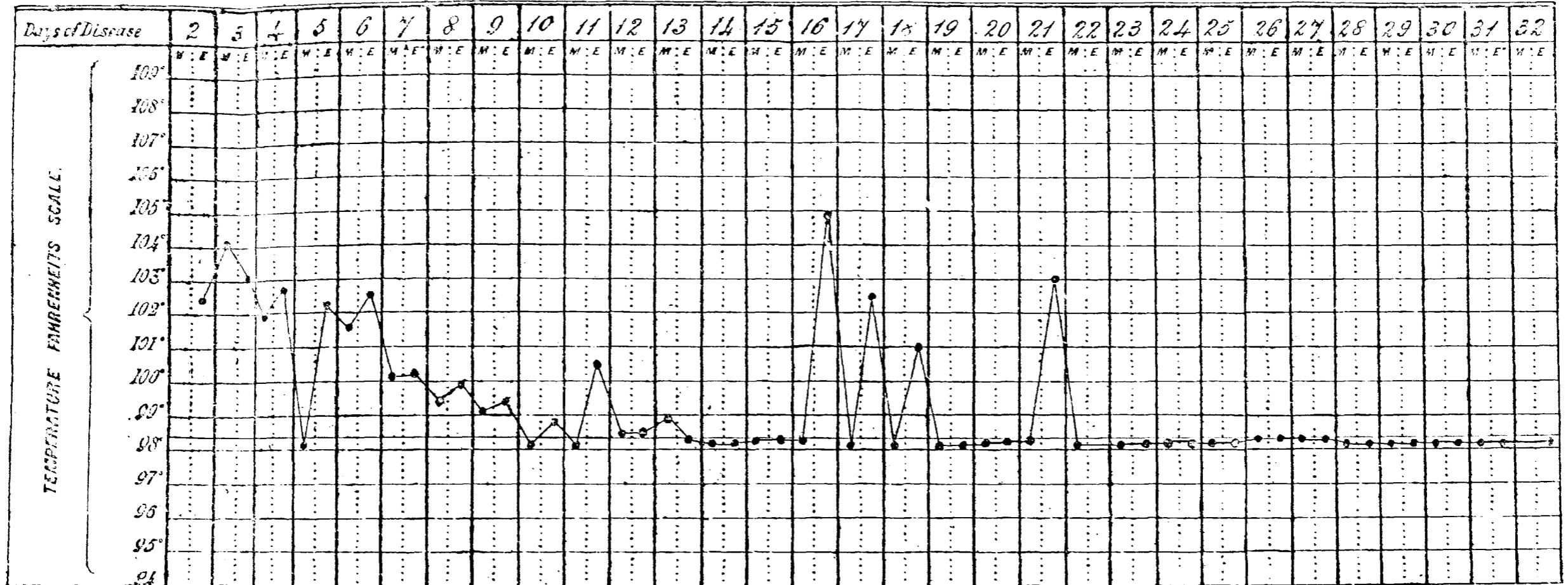


Chart of a case of simple bubonic plague with right femoral bubo: bubo injected with liq. iodi m. 10 on the 3rd day of disease; it suppurated and was incised on the 9th day: a fresh bubo, deep iliac, developed on the 16th day, temperature went up to 105°, it subsided and ended in resolution; temperature again rose on the 21st day, from some accumulation of pus in the wound: patient made a good recovery.

# CHART XXX

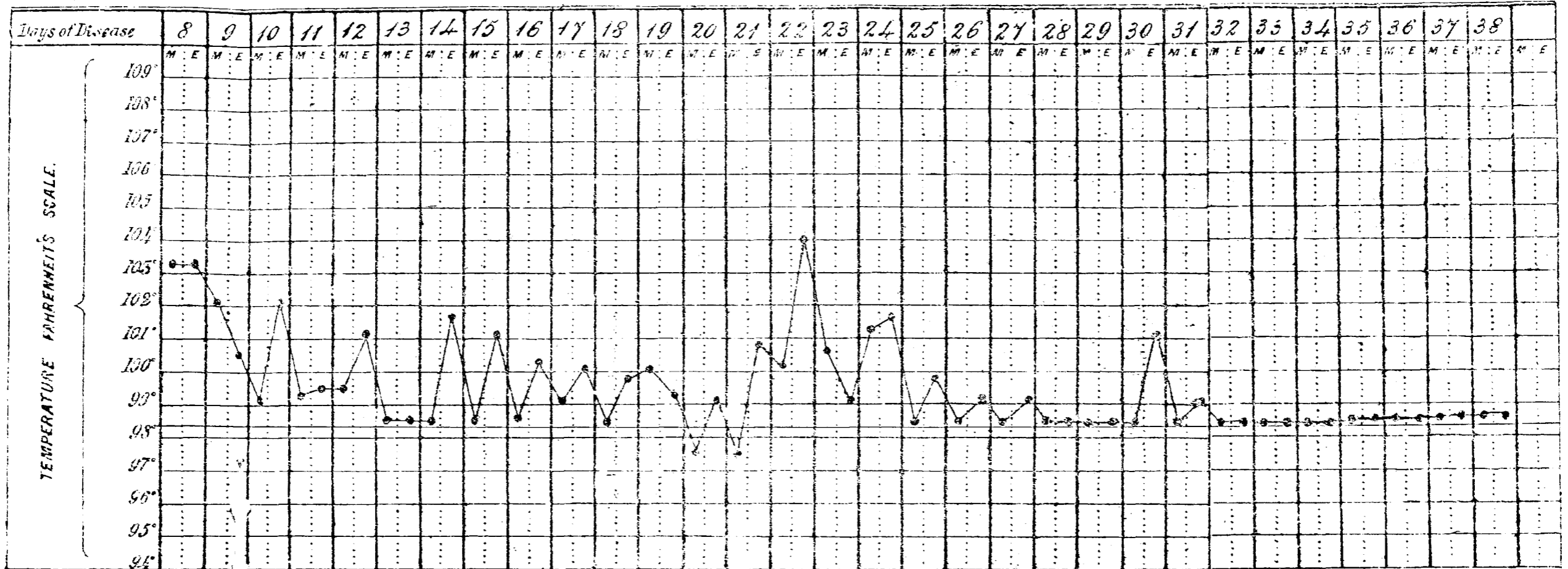


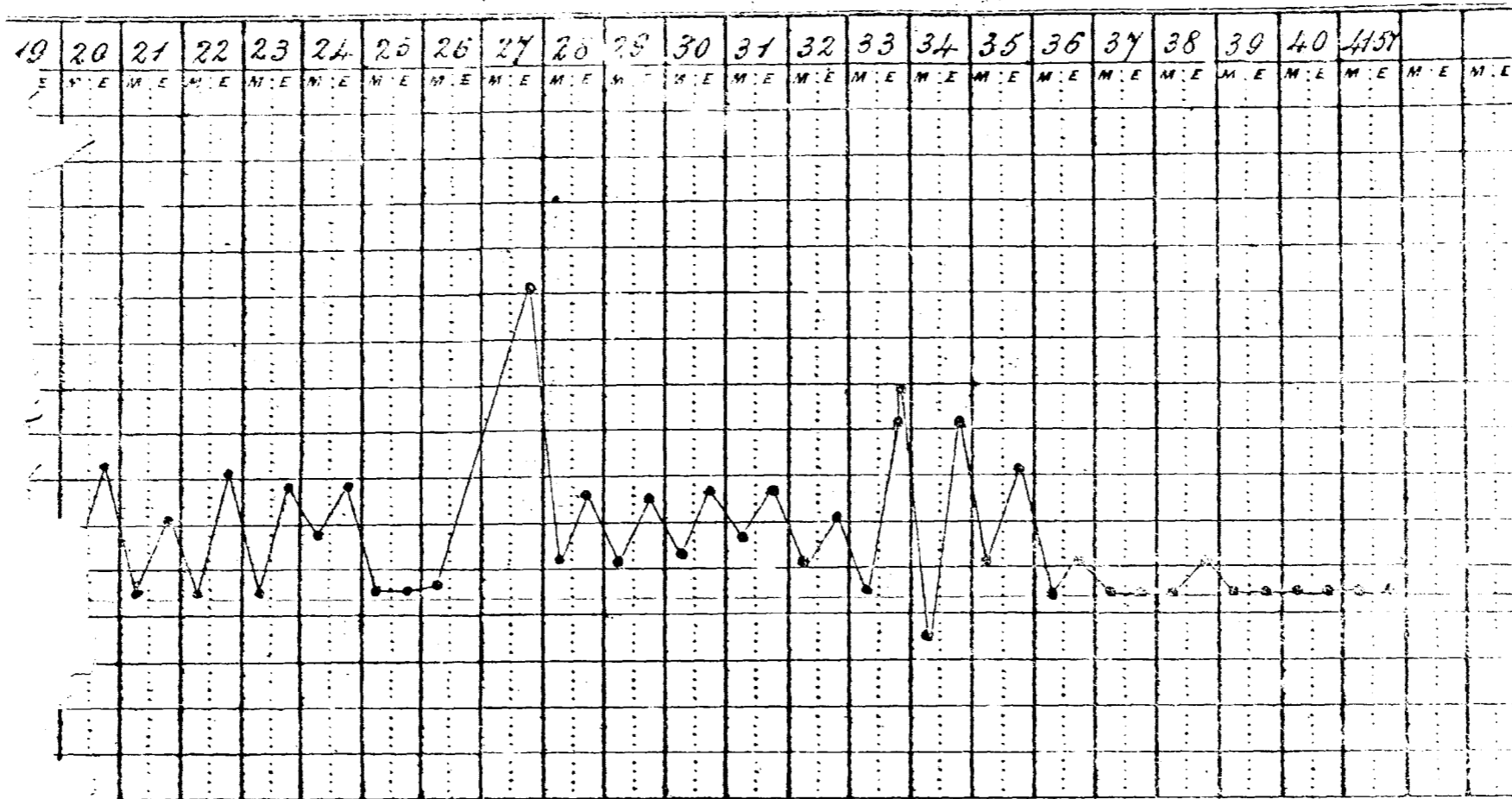
Chart of a case of simple bubonic Plague, with suppuration in bubo: bubo incised on the 12th day of disease: a fresh bubo appeared above the Poupart's ligament on the 22nd day of disease, and ended in resolution, the patient making a good recovery.





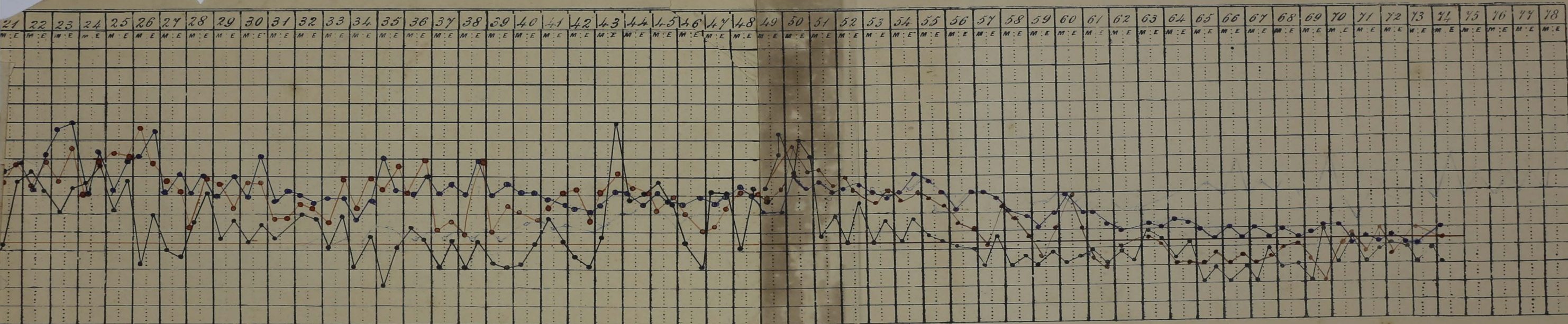


- 10. Joint Select Committee on Govt. of India Act, Draft Rules - First Report, 1920.   
 H. 239-242. V2:2.N195 FO 1
- 11. dto. - Second Report, 1920.   
 H. 243-245. V2:2.N195 FO 2
- 12. dto. Minutes of Proceedings.   
 H. 246-249. V2:2.N195 FO 3
- 13. Draft Rules for Elections to Provincial Legislative Councils. (Ord. 757.) 1920.   
 H. 250-290. V2:1:91.N11 FO
- 14. dto. (as approved by Joint Select Committee.) (Ord. 812.) 1920.   
 H. 291-334. V2:1:91.N11 FO
- 15. Draft Electoral Rules for Indian Legislature (Ord. 769.) 1920. H. 335-360   
 V2:1:91.N11 FO
- 16. dto. (as approved by Joint Select Committee.) (Ord. 812.) 1920.   
 H. 361-388. V2:1:91.N11 FO
- 17. Draft Rules for Local Legislative Councils.   
 H. 389-397. V2:1:91.N11 FO
- 18. Non-Official (Definition) Rules. 1919.   
 H. 398-399. V2:1:91.N11 FO
- 19. Statements showing Classification of subject pertaining to Judicial Department.   
 H. 400-426. V2:1:15.N15 FO
- 20. dto. Political Department.   
 H. 427-445. V2:1:15.N15 FO
- 21. dto. Legal Department.   
 H. 446-447.
- 22. Memorandum of All-India Mahratta League, 1919 (S. L. Srinde &c.) H. 448-470.   
 V2:2.N11 FO
- 23. Chintamani's Memorandum to Muddiman Committee, 1924. H. 471-495.   
 V2:2.N24 FO



about 22, belonging to the Bombay Police ; a man of good physique and powerful build, fair looking, height  
 objected, and the buboes incised on suppuration. A large mass in the pelvis appeared on the 27th day with high  
 mass gradually resolved. Patient was not discharged from hospital till the 57th day, and so far as physique  
 seen about 3 months afterwards, on his return, from change to his country but he had still a wan and pale

# CHART XXXVI



ed case of simple bubonic plague, with complications, and ending in complete recovery on the 74th day. Patient, a young Hindu, had a right axillary bubo which was injected with liq: iodi m. 20, on the 9th day: secondary pneumonia showed itself on the 3rd day, and this was followed by pleurisy with effusion on the 5th day. Gangrene of lung supervened on the 24th day. The patient gradually subsided, the patient making an ultimate recovery.