



MINISTRY OF HEALTH

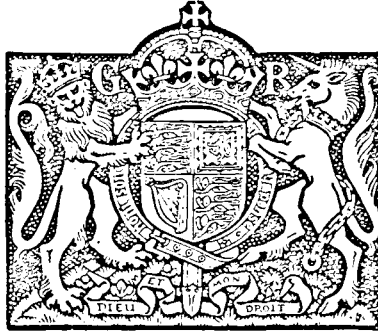
Interim Report
of
Departmental Committee
on
Maternal Mortality & Morbidity

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CONSTITUTION AND TERMS OF REFERENCE OF COMMITTEE.

I hereby appoint—

Professor F. J. Browne, M.D., F.R.C.S.
 Dame Janet M. Campbell, D.B.E., M.D., M.S.
 Mrs. Ethel Cassie, M.D.
 Leonard Colebrook, Esq., M.B.
 Professor Archibald Donald, M.D., F.R.C.P.
 C. E. S. Flemming, Esq., M.R.C.S., L.R.C.P.
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 Sir George Newman, K.C.B., M.D., F.R.C.P.
 W. H. F. Oxley, Esq., M.R.C.S., L.R.C.P.
 Professor Miles H. Phillips, M.B., F.R.C.S.
 C. E. Tangye, Esq., M.D.
 O. L. V. S. de Wesselow, Esq., M.B., F.R.C.P.

to be a Departmental Committee to advise upon the application to maternal mortality and morbidity of the medical and surgical knowledge at present available, and to inquire into the needs and direction of further research work.

I further appoint Sir George Newman to be Chairman and Mrs. Margaret Hogarth, M.B., of the Ministry of Health, to be Secretary, of the Committee.

(Signed) N. CHAMBERLAIN.

4th June, 1928.

Note.—Owing to illness Dr. Margaret Hogarth was unable to undertake the duties of Secretary, which were discharged by Miss Jane H. Turnbull, C.B.E., M.D., one of the Medical Officers of the Ministry of Health.

The cost of the preparation of this Report, including the expenses of the Committee, is £1,165 7s. 9d. The cost of printing and publishing this Report is estimated by H.M. Stationery Office to be £156.

DEPARTMENTAL COMMITTEE ON MATERNAL MORTALITY AND MORBIDITY.

INTERIM REPORT.

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Departmental Committee on Maternal Mortality and Morbidity.

INTERIM REPORT.

The Right Hon. Arthur Greenwood, M.P.,
Minister of Health.

SIR,

1. We have the honour to submit the following Interim Report and Recommendations in response to the reference which your predecessor in office entrusted to us in the Minute dated 4th June, 1928. We have held 42 meetings of the General Committee and its Sub-Committees, and in an appendix will be found a list of the names of witnesses who have appeared before us or conferred with us on the subject of our Inquiry. Its nature, and the duties with which we were charged, entails a somewhat protracted investigation which is not yet complete, but we think it expedient to submit an interim statement at the present stage. The report is concerned with the result of our consideration of upwards of 2,000 maternal deaths, and contains certain recommendations for the prevention of the deplorably high death rate attributed to childbirth. We propose to reserve for a subsequent report further inquiries and recommendations concerning morbidity associated with pregnancy and the puerperium, puerperal sepsis, statistical aspects of the maternal mortality rate, methods of public education in the preventive side of the problem, and some outstanding questions involving research in which we are now engaged, together with an account of our investigation into an additional number of maternal deaths.

CHAPTER I.

2. The total mortality among women during pregnancy and childbearing has remained almost stationary for many years. It was one of the first subjects to which the Ministry of Health gave its attention on its establishment in 1919, as the first Minister of Health (Dr. Addison) recognised its paramount importance to the

wider problem of the national health. A special section of the Medical Department of the Ministry was created at that time to deal with maternity and child welfare staffed by medical women under the direction of Dame Janet Campbell. In the ten years which have followed action has been taken to awaken public interest in the subject and to guide Local Authorities in their administration of the Public Health Acts chiefly concerned with it (Midwives Acts, 1902-1926, Notification of Births Acts of 1907 and 1915, Maternity and Child Welfare Act, 1918, *et seq.*). Two special reports (Maternal Mortality, 1924, and the Protection of Motherhood, 1928) and numerous administrative circulars have been issued by the Ministry; maternity and child welfare centres, ante-natal clinics, and maternity homes and hospitals have been established in the areas of Local Authorities, and other means have been taken in the endeavour to reduce the number of preventable deaths among mothers, including a measure to which some authorities attach considerable importance—the supply of milk or meals to expectant mothers in necessitous circumstances, on grounds of health, during the last three months of pregnancy. Nor has renewed interest been lacking in the medical profession, both in research work and in practice, supported by a powerful and increasingly enlightened public opinion. Nevertheless, and in spite of the continuous improvement in the health of the child and the remarkable reduction in the infant mortality rate, there has been no corresponding reduction in maternal mortality.

The principal features of the present position are obvious. Since 1911-15 the birth rate has fallen from 23·6 per 1,000 living to 16·3 in 1929; the general death rate has fallen from 14·3 per 1,000 to 13·4 in 1929 (and in the nine previous years it was even lower); and the infant mortality rate has declined from 109 in 1911-15 to 74 in 1929 (having reached 65 in 1928). On the other hand, the total maternal mortality from childbirth itself in 1911-15 was 4·0 per 1,000 women giving birth to live children, 4·12 in 1916-20, 3·9 in 1921-25, and in 1929 reached the figure of 4·3 per 1,000. Much the same static position has obtained in regard to the mortality of women in childbirth from non-*puerperal* causes, *i.e.*, from morbid conditions associated with and aggravated by childbirth, but not from childbirth itself. In other words, in spite of the general and particular advance of the science and art of medicine in its application to childbirth, and in spite of the efforts made and arrangements designed to reduce this death rate, the mortality position remains, on the whole, unimproved.

In varying degree, the problem is common to all countries, but exact comparison of the English maternal mortality rate with that of other countries cannot be made, partly because of differences in classification and partly because of incomplete returns. The number of live births and of maternal deaths for the years 1923-27 inclusive are available for six European countries and for Australia, New Zealand and South Africa. The maternal mortality rate calculated from these figures shows that while in three of the countries (Denmark 2·6; Finland 3·1; Norway 2·8) the average for the five years is much lower than that of England and Wales (4 per 1,000), it is considerably higher in Australia (5·5), Belgium (5·6) and

Germany (5.1), and slightly higher in Switzerland (4.4), New Zealand 4.8, and South Africa (4.9).

It may be interesting to note also recent death rates in one or two other countries where the available records for the years taken above (1923-27) are incomplete. Thus for France (1925-27) the rate is 2.5; Holland (1921-25) 2.4; Italy (1922-26) 2.8; United States of America (Birth Registration area, 1921-25) 8.3. The low death rate in the Scandinavian countries and in Holland has been frequently noted and not fully explained, although the great attention paid to the training and status of midwives in these countries probably plays an important part.

The situation is made manifest in the following composite table prepared for the Committee by the Registrar-General:—

England and Wales. Birth and Death Rates per 1,000 living; Infantile Mortality rates; and Mortality of Women in or associated with Childbirth per 1,000 Children born alive, 1911-1929.

Year.	Birth rate.	General Death rate.	Infantile mortality rate.*	Puer-peral Sepsis.	Other puer-peral causes.	Total puer-peral mortality.	Non-puer-peral causes.	Total Maternal Mortality.
1911-15	23.6	14.3	109	1.42	2.61	4.03	0.99	5.02
1916-20	20.1	14.4	91	1.51	2.61	4.12	1.68	5.80
1921-25	19.9	12.2	75	1.40	2.50	3.90	1.14	5.04
1911 ...	24.4	14.6	129	1.43	2.44	3.87	1.04	4.91
1912 ...	24.0	13.4	95	1.39	2.59	3.98	0.97	4.95
1913 ...	24.1	13.8	109	1.26	2.70	3.96	0.91	4.87
1914 ...	23.8	14.0	104	1.55	2.62	4.17	0.95	5.12
1915 ...	21.8	15.7	106	1.47	2.71	4.18	1.09	5.27
1916 ...	21.0	14.3	91	1.38	2.74	4.12	0.94	5.06
1917 ...	17.8	14.2	91	1.31	2.58	3.89	0.95	4.84
1918 ...	17.7	17.3	98	1.28	2.51	3.79	3.81	7.60
1919 ...	18.5	14.0	93	1.67	2.70	4.37	1.98	6.30
1920 ...	25.5	12.4	85	1.81	2.52	4.33	1.13	5.46
1921 ...	22.4	12.1	81	1.38	2.53	3.91	1.09	5.00
1922 ...	20.4	12.8	75	1.38	2.43	3.81	1.35	5.16
1923 ...	19.7	11.6	69	1.30	2.51	3.81	1.01	4.82
1924 ...	18.8	12.2	74	1.39	2.51	3.90	1.16	5.06
1925 ...	18.3	12.2	75	1.56	2.52	4.08	1.07	5.15
1926 ...	17.8	11.6	70	1.60	2.52	4.12	1.02	5.14
1927 ...	16.6	12.3	70	1.57	2.54	4.11	1.32	5.43
1928 ...	16.7	11.7	65	1.79	2.63	4.42	1.20	5.62
1929 ...	16.3	13.4	74	1.80	2.53	4.33	1.49	5.82

* The rates for the years 1911-25 have been corrected for the violent fluctuations in the birth-rate during those years by stating the deaths in proportion to infants born alive during the same three monthly periods as those which died, and not to births registered in the same year.

3. It was this situation which led your predecessor as Minister of Health (Mr. Neville Chamberlain) to appoint two Committees of Inquiry; one, to consider the administrative working of the Midwives Acts of 1902-26, with special reference to the training of midwives (including its relation to the education of the medical student in midwifery) and the conditions under which midwives are employed*; the other, "to advise upon the application to maternal mortality and morbidity of the medical and surgical knowledge at present available, and to inquire into the needs and direction of further research work."

The appointment of the second Committee was foreshadowed in an official circular of the Ministry of Health (No. 888) issued on April 23rd, 1928, which referred, *inter alia*, to an investigation, first suggested in 1924, in every sanitary area of all maternal deaths by an experienced medical officer, with a view to ascertaining more exactly the actual cause which led to them, in order to provide further means of prevention. In order that such information should provide proper and sound material for valid deduction and practical use it was necessary that the inquiry should proceed on approved lines and be directed to certain definite points. Further, the data so obtained should be considered by some competent body which would collate and classify the information received from this and other sources, would formulate the conclusions to be drawn, and would indicate the lines on which further research is desirable, and advise what future action could be taken to bring about a progressive reduction in maternal mortality.

4. Obviously, therefore, the first business of the Maternal Mortality Committee was to prepare a form of questionnaire which would serve as a model for the inquiries into maternal deaths. In drafting this questionnaire the Committee had regard to the desirability that the inquiry should cover all maternal deaths from any cause, whether puerperal or not, and that the particulars should be sufficiently full to be of practical use, though not so detailed as to be burdensome; that the inquiries must be strictly confidential and that their results should be referred directly to the Ministry of Health; and that the giving of particulars by the doctor concerned should be voluntary. With these considerations in mind the matter was closely considered at the first meeting of the Committee held on June 21st, 1928. It was suggested that the responsibility for the conduct of the inquiry should be placed upon certain whole-time medical officers of health in the areas in which the deaths occurred, it being open to them to obtain such special medical assistance as they deemed fit in the particular circumstances. The draft form of inquiry was finally approved by the Committee, concurred in by the British Medical Association, and issued by the Ministry of Health to the Local Authorities on the 24th October, 1928. A copy of the form of this

* Report of Departmental Committee on the Training and Employment of Midwives, 1929.

questionnaire is printed in the Appendix. Following upon its issue it soon became apparent that the Committee would require some expert medical assistance for the preliminary examination and classification of the returns, which had to be not only examined, but summarised, commented upon and submitted to the Clinical Sub-Committee. Accordingly, it was decided to appoint (part-time) two medical examiners, who would be jointly responsible to the Committee for this task.

5. For the convenience of the Committee's general business three Sub-Committees were appointed:—

- (a) Physiological and Pathological Research (Chairman, Sir Walter Fletcher);
- (b) The Clinical Aspects of the Problem (Chairman, Dr. Oxley); and
- (c) The Public Health Aspect and Public Education (Chairman, Dr. Tangye).

It may be added that though Dr. Margaret Hogarth was appointed Secretary to the Maternal Mortality Committee she was not able to take up her duties owing to temporary ill-health, and the Committee requested Dame Janet Campbell, one of its members, to act provisionally as Secretary; in her absence in Australia for six months (1929-30) Dr. Jane Turnbull, a medical officer of the Ministry, undertook the duties of Secretary, and has continued in this capacity to the present date.

6. Early in 1929 the Committee were in a position to prepare a memorandum on the methods of staffing and conducting an ante-natal clinic, together with a résumé of ante-natal examination which, in their opinion, ought to be regarded as the minimum necessary to ensure a pregnant woman against avoidable risks. The Committee regarded this matter as so important that they recommended the Minister to publish the Memorandum forthwith, and the document was issued on the 31st July.*

* *Vide* Appendix, p. 140.

CHAPTER II.

REPORT ON MATERNAL DEATH INVESTIGATION.

7. In pursuance of the arrangements described in the first chapter, a form of inquiry was drawn up by the Committee after careful consideration of the facts to be elicited, and the Medical Officer of Health of the appropriate Local Authority was invited to be responsible for the completion of the forms. It was suggested by the Ministry that a consultant or a specially qualified practitioner should be nominated to assist the Medical Officer of Health in cases of unusual difficulty, and in some areas this suggestion has been adopted. In most areas the actual inquiries from doctor, midwife or institution have been undertaken by the Medical Officer of Health himself or by a suitably qualified member of his staff.

The preliminary scrutiny and classification of the forms on lines laid down by the Committee were entrusted to two Medical Examiners appointed by the Committee for this purpose—Mr. G. F. Gibberd, F.R.C.S., Obstetrical and Gynæcological Registrar, Guy's Hospital, and Mr. Arnold Walker, F.R.C.S., Assistant Obstetric Surgeon, The City of London Maternity Hospital. The Committee are greatly indebted to them for the accuracy, industry and good judgment with which they have carried out the onerous and difficult task of preparing these reports for the consideration of and examination by the Committee.

Reports Received.

8. From the time the Committee commenced work in November, 1928, until April 30th, 1930, 3,079 reports have been received. During the first few months of the investigation, the number received was relatively small, but it has increased steadily, until at the present time it is estimated that about two-thirds of all the maternal deaths in England and Wales are coming before the notice of the Committee. These are unselected cases, and the Committee believe that they are representative of the deaths occurring all over the country. In this interim report the first 2,000 cases only are being considered; the remainder will form the basis of further investigation on the part of the Committee.

For obvious reasons it is difficult to obtain accurate and detailed information in many cases of death in childbirth, and without the willing co-operation of those concerned in almost all these investigations it would have been impossible. Even so, the data were not always sufficiently full or correct to enable definite conclusions to be drawn, and such reports were useless for comparative purposes. In the majority, however, the report was considered reliable, though not necessarily adequate. This inadequacy, indeed, has impressed the Committee with the need for fuller and more detailed records being kept by doctors and midwives of all midwifery cases. Taken

as a whole, however, the material with which the Committee has had to deal has justified the hope that more light would be thrown on the conditions under which midwifery is practised throughout the country—and having regard to the difficulties inherent in collecting the information, the reports furnish a new and most valuable contribution to our knowledge.

Analysis.

9. The 2,000 deaths considered in this report have been divided into two classes—a first group comprising deaths directly due to pregnancy and childbearing (including abortion and ectopic gestation) and numbering in all 1,596, and a second group comprising deaths due to an independent disease, concurrent with pregnancy or childbirth, in which child-bearing contributed to or accelerated death or was present merely as an incident. In this group there were 404.

Class I. Deaths Directly Due to Child Bearing.

Total, 1,596.

These have been divided into the following sub-classes, which have been based on clinical rather than pathological causes of death. Each death has been entered under one sub-class only.

TABLE I.
Deaths directly due to childbearing.

	Percent.
1. Sepsis	616 33·6
2. Eclampsia	213 13·6
3. Operative shock, etc	145 9·0
4. Ante-partum haemorrhage	125 7·8
5. Post-partum haemorrhage	92 5·7
6. Other toxæmias, including chorea and mania	99 6·2
7. Embolism	113 7·0
8. Abortion	163 10·5
9. Extra-uterine gestation	20 1·2
Total	1,596

These figures may be studied in connection with the following table from the Registrar-General's Returns for 1923. It will be noted that the groups do not and cannot exactly correspond, as the Registrar-General's classification could not conveniently be adopted for the type of clinical investigation undertaken by the Committee nor for a particular group of cases.

TABLE II.

Causes of Death as recorded by Registrar-General in 1928.

	Per cent.
Abortion	77 = 2·60*
Ectopic (extra-uterine) gestation	86 = 2·90
Other accidents of pregnancy	106 = 3·60
Puerperal haemorrhage	331 = 11·30
Other accidents of childbirth	331 = 11·30
Puerperal sepsis	1,184 = 40·50
Puerperal phlegmasia alba dolens not returned as septic	31 = 1·00
Puerperal embolism and sudden death	188 = 6·40
Puerperal albuminuria and convulsions	557 = 19·00
Childbirth not assignable to other headings	21 = 0·72
Puerperal diseases of the breast	8 = 0·27
Total	2,920

There is, however, sufficiently close correspondence in the percentages to suggest that the deaths investigated by the Committee are fairly representative of the whole number occurring in England and Wales.

As the reports received by the Committee contain more or less complete clinical records of the cases, as well as the "cause of death" as stated on the death certificate, it has been possible to arrive at conclusions which should be more accurate than those based merely on the information given in a death certificate—and in some instances, in view of the information at its disposal, the Committee has thought fit, after full consideration of all the records at its disposal, to assign the death to some cause other than the one entered on the certificate.

10. Certain clinical points of interest have emerged from the reports, and some mention of them may be made here.

1.—*Sepsis.*

The tables show that there were 616 deaths from sepsis, nearly one-third of all the fatal cases. This is a particularly important group to consider, as it is in the reduction of deaths from this cause that we may look for most improvement in the statistics of morbidity and mortality. Such deaths from sepsis have been divided into three classes.

- (1) Sepsis following ordinary normal labour.
- (2) Sepsis following delivery by low forceps, labour being otherwise normal.
- (3) Sepsis following complicated labour.

Classes (2) and (3) have been differentiated because the frequency with which delivery is effected in private practice by means of the forceps is such that the Committee considered that it would be inaccurate to classify all such cases as complicated labour. In all the cases included in class (2) there seemed to be no particular reason for the operation beyond slight delay during the second stage of labour. In class (3) are included "difficult" forceps

* Cases of abortion (224 during 1928) where death resulted from sepsis are under Puerperal Sepsis. Deaths due to criminal abortion (57 during 1928) are not included in this table.

deliveries, severe lacerations, and manual removal of the placenta, in addition to all other complications of labour. Such complications include abnormal haemorrhage and toxæmia, where the patient did not die directly from the complication but from subsequent sepsis. The number of cases falling into each group were 294 following normal labour, 47 following the application of low forceps in an otherwise normal labour, and 275 following complicated labour (in 42 of which the placenta was removed manually).

It will be noted that a large proportion of deaths followed normal labour, and in the majority of these cases there was no positive evidence of any mismanagement during delivery. It must not be assumed, however, that the methods used were necessarily satisfactory. For instance, the records are not always sufficiently explicit to enable the Committee to state the number of cases in which no vaginal examination was made, nor to decide as to the efficiency of the antiseptic technique employed. At some stage or other in many of these cases there is likely to have been some failure to exercise due care which was ultimately responsible for a fatal issue. In others there may have been some unobserved or unrecorded error in the habits or hygiene of the patient herself which if known might explain the onset of sepsis.

There was definite evidence that sepsis had occurred in epidemic form in a few instances, and that contagion from case to case had been established. The majority of deaths from sepsis seem, however, to have occurred as isolated cases in the practice of an individual or hospital, and from the information in the returns, the Committee have been unable to obtain any convincing evidence of direct spread from patient to patient as an important factor in maintaining the high and increasing death rate from puerperal sepsis. This may be due partly to the fact that the steps now generally taken to control or prevent epidemics are not infrequently efficient, but also to the fact that the investigation of individual deaths does not necessarily cover the whole field which it is necessary to survey in dealing with an epidemic, which should include particulars of non-fatal as well as fatal infections.

11. *Disinfection.*—Amongst the 616 deaths from sepsis the nature of the antiseptic used was the subject of investigation. In about half the cases Lysol alone was used (305). Mercury preparations were used in 92 cases, and other antiseptics (or unstated) in 219 cases (in some of which almost certainly lysol was used). There thus appears to be a widespread use of lysol and a comparatively infrequent use of mercury salts; but the data are too scanty to enable the Committee to do more than form a general impression.

In few of the reports on fatal cases of sepsis have the scheduled questions under "disinfection" been answered in detail. Particulars are in the majority of reports incompletely given as to the preparation of the patient, the disinfection of the hands of doctor, midwife or nurse, or the practice as to the use of swabs, gloves, sterilised pads, towels, etc. Further, in more than a third of the

cases there is no statement of any antiseptic at all having been used. It may be argued that the doctor has regarded these details as matters of course; on the other hand, he may have regarded them as unimportant. The fact remains that we have little positive information of any value on the subject of the use of antiseptics.

Serious lack of adequate antiseptic precautions—whether due to ineffective antiseptic solutions or to carelessness in utilising antiseptics—probably accounts for the morbidity in many of the cases of normal labour, and also probably in many of the forceps deliveries. The whole question of the adequate disinfection of the hands and instruments of the professional attendants, as well as of the surroundings and person of the patient, is one which deserves and indeed necessitates far more attention than it apparently receives.*

Some brief notes may be added on some other features of the deaths attributed to sepsis. The day of onset of pyrexia was recorded in 544 cases, and in 66 per cent. of these it was observed within the first three days.

The duration of the illness was noted in 607 cases as under: one week in 276; from one to two weeks in 182; and longer than two weeks in 149.

The relationship between deaths from sepsis and prolonged labour is indicated by the fact that the duration of labour was over 24 hours in 97 cases out of 307 in which a note was made on the point.

2. *Eclampsia.*

12. Under this heading are included all cases of toxæmia in which convulsions or fits occurred. They numbered 218. In 105 cases the urine was tested with some degree of regularity. In 43 of these no albumin was found, but as the date of the last examination of urine was given in very few cases, the conclusion that albumin was in fact absent until the onset of symptoms cannot fairly be drawn. In 62 albumin was found. Of these, very few received treatment in accordance with the best modern practice and in 41 treatment was definitely deficient. In 113, i.e., over half the cases, the urine was either not tested at all, or was tested only occasionally. In 23 cases there is a record of blood pressure having been taken before the onset of fits. After the onset of fits the records of blood pressure are so seldom available that no data can be given on the subject.

The Committee consider that both the evidence before them and their own experience support the well-established view that, apart from the cases of fulminating eclampsia which may occasionally occur either before or after delivery within a short time after a normal blood pressure reading and urine test, eclampsia is almost entirely a preventable disease, provided (a) that urine and blood pressure tests are made regularly and with sufficient frequency throughout preg-

* A special report on the Sterilisation of the Hands has been drawn up by Dr. Leonard Colebrook, a member of the Committee, and is printed in the Appendix to the Report.

nancy, and (b) that adequate and prompt treatment is carried out should an abnormality arise.

In the series of cases under review it is estimated that 51·7 per cent. of the deaths from eclampsia can safely be attributed primarily to non-detection of the albuminuria, and that efficient ante-natal examination would probably have enabled the fatal result to be avoided. Amongst the cases where albumin was detected, the Committee were impressed by the comparatively frequent absence of competent treatment and particularly by the failure to secure admission to hospital. In some, this was due to the refusal of the patient to follow her doctor's instructions; in others, to the fact that the serious implications of the early signs of illness were not recognised or appreciated by the professional attendant; but in many, treatment failed owing to the difficulty or impossibility of obtaining hospital accommodation for the patient during pregnancy. It is true that 89 of the 218 fatal cases of eclampsia were eventually admitted to hospital as emergency cases, but this was clearly too late for effective preventive or curative treatment.

The Committee realise the futility of attempting to treat a pregnant woman with albuminuria in her own home where she has her household duties always before her, and they consider that in such circumstances the provision of more hospital beds for ante-natal observation and treatment would save much morbidity and many lives every year.

It must not be forgotten that the transport by ambulance of patients suffering from eclampsia without previous injection of morphia or provision for the administration of chloroform *en route* is an undoubted aggravation of risk.

There were 150 cases of *ante-partum* and *intra-partum* eclampsia; the method of delivery was spontaneous in 49, in 33 it was by forceps, in 12 by Caesarean section, and in 11 by accouchement forcé; 45 died undelivered. The remaining 68 were cases of *post-partum* eclampsia. Of the 218 cases of eclampsia, 115 (53 per cent.) occurred in primiparae.

Information as to methods of treatment adopted was not sufficient to enable any conclusions to be drawn, but this was scarcely to be expected from the scope of this inquiry. The Committee were, however, surprised to find that accouchement forcé is still practised in the treatment of cases of eclampsia and of *ante-partum* haemorrhage.*

3. Shock.

13. Death was attributed to shock in 145 cases. This group includes a number of cases in which death occurred shortly after extensive obstetric interference. It contains therefore cases where death was due to rupture of the uterus. Deaths apparently due to the immediate action of an anaesthetic have also been included here.

* The treatment of eclampsia is the subject of investigation at the present time under the direction of a standing committee of the Royal Society of Medicine.

Such a variety of complications occurs in this group, the exact nature of which was frequently undiagnosed, that no useful classification can be made. Reference is made to this in the Section of this chapter dealing with the "primary avoidable factor" and such information as the Committee have been able to extract is considered under that heading.

4. *Ante-Partum Haemorrhage.*

14. The total number of cases of this complication was 125; only cases actually dying from haemorrhage are included.

(i) *Placenta praevia.*—The number of cases of placenta praevia was 72, of which 35 cases were treated by version, 13 by vaginal plug, and 6 by both methods. Caesarean section was performed in 6 cases. In 9 no treatment seems to have been attempted. Accouchement forcé was practised in 3 cases.

(ii) *Accidental haemorrhage* was the cause of death in 53 women.

The method of treatment which was used in these cases is shown in the following table:—

1. Vaginal plug	10
2. Version	8
3. Forceps delivery	6
4. Rupture of membranes	4
5. Caesarean section	4
6. Accouchement forcé	2
7. Vaginal plug and version	1
8. No active treatment	18

Of the 125 fatal cases of ante-partum haemorrhage, only 13 had been booked for confinement in hospital, and in addition to this number 65 were admitted for labour as emergency cases. Thus 47 out of the 125 cases were delivered, or died undelivered, in their own home, where facilities for proper treatment were seldom available. In the vast majority of cases there had been a warning haemorrhage some days (often some weeks) before the fatal haemorrhage, and had this been heeded, and the patient removed to suitable surroundings, the fatal result might well have been avoided in many cases. Usually the failure to take heed lay with the patient—in a few cases the doctor or midwife had considered the premonitory bleeding of no importance, and in some cases, although the potential seriousness had been recognised, institutional treatment was not available.

In cases of ante-partum haemorrhage treated in the patient's own home, the comparative rarity with which injections of saline solution were given by intravenous or even subcutaneous methods or administered per rectum is significant.

5. *Post-Partum Haemorrhage.*

15. There were 92 women who died directly from post-partum haemorrhage. The Committee have been impressed with the general

absence in cases of post-partum haemorrhage of any active attempts to combat the effects of blood-loss by prompt supply of fluid. In none of the cases reviewed was a blood transfusion given, and in only a small proportion was subcutaneous, intravenous (10 cases) or rectal (20 cases) saline used. Thus in 62 cases (67 per cent.) no attempt whatever was made to replace body fluids except by the mouth.

In 53 out of the 92 cases the haemorrhage followed a normal first and second stage of labour.

The method of delivery of the placenta in the fatal cases of post-partum haemorrhage was spontaneous (or "expression") in 51 instances, by manual removal in 33 (35·8 per cent.), and there were 8 undelivered.*

6. *Other Toxaemias.*

16. This group (99 cases) includes deaths due to pregnancy albuminuria without fits (not chronic nephritis), hyperemesis gravidarum, delayed chloroform poisoning, mania and chorea. The history of many cases was difficult to interpret or understand from the reports, and only in a few cases was a post-mortem examination made.

7. *Embolism.*

17. In many instances in this group (containing 113 cases) the Committee were not entirely satisfied as to the accuracy of the alleged cause of death, since it was frequently unconfirmed by post-mortem examination, and the circumstances under which the death occurred were not always suggestive of embolism. However, where the Committee had not sufficient evidence to assign a different cause of death, the cause stated on the report or the certificate has been accepted. The true number of deaths from embolism is therefore probably overstated. Out of the 113 cases pyrexia was noted in only 23, and venous thrombosis in only 22 cases.

8. *Deaths Due to Abortion.*

18. These have been included in the figures considered above, but no further comment is made here since an analysis of the cases of abortion which have been investigated by the Committee is included in a special section of the present Report. The number of deaths directly due to abortion occurring amongst the 2,000 returns received was 168.

9. *Deaths Due to Extra-Uterine Gestation.*

19. These deaths, 20 in number, presented no special features. The small number reported may have been due to doubt whether these cases were relevant to the present inquiry.

* There is no information as to whether the term "expression" implies expression from the uterus or from the vagina.

The Operation of Caesarean Section.

20. Amongst the total number of deaths 112 followed the operation of Caesarean section (the extraction of the child through the abdominal wall). It will be understood that this major operation is necessitated in cases in which it proves impracticable to deliver the child through the natural passages, or where circumstances demand exceptionally rapid delivery in the interest of mother or child. The risks of this method of delivery naturally vary in accordance with its occasion and urgency, but in ordinary circumstances, and where the operation is a matter of deliberate selection and preparation, the dangers are not exceptional and the mortality is usually low (from 1 to 2 per cent.)* These 112 deaths occurring out of the 2,000 under consideration were certified by the doctors in attendance or by our investigators as follows:—

TABLE III.

Cause of Death.	Number of Cases.
Sepsis	46
Shock	17
Toxaemia	15
Pulmonary embolism	10
Pneumonia	7
Haemorrhage	7
Ileus	6
Renal failure	2
Splenic anaemia	1
Heart disease	1

The indications for which the Caesarean section was stated to have been performed are shown in the following table:—

TABLE IV.†

Disproportion	64
Toxaemia	16
Placenta praevia	12
Pelvic tumour	6
Concealed accidental haemorrhage	5
Ruptured uterus	3
Transverse lie	2
Heart disease	2
Carcinoma of cervix	1
Splenic anaemia	1

It is seen that sepsis is the most important single factor in death following Caesarean section, and in the majority of the cases under review in which death was due to this cause the operation was performed late in labour, sometimes after previous attempts at delivery had been made. The Committee consider that many of the deaths, therefore, could have been avoided had proper ante-natal care and

* Munro Kerr and Eardley Holland. *Journal of Obstetrics and Gynaecology of the British Empire.* No. 28. 1921.

† The discrepancy between the figures for placenta praevia and accidental haemorrhage in this table and those in para. 14 is accounted for by the fact that some of the cases where Caesarean section was performed on account of haemorrhage died later from sepsis and so are not included in the section on haemorrhage.

foresight during labour been available, or had the operation been performed before the birth canal had become infected.

Class II.—Deaths not Primarily Due to Pregnancy.

21. Out of the total of 2,000 deaths, 404 were returned as attributable to concurrent disease associated with childbirth as follows:—

TABLE V.
Incidental Deaths.

Lung diseases (not tuberculosis)	153
Heart disease	98
Chronic renal disease	40
Pulmonary tuberculosis	26
Cerebral haemorrhage	18
Scarlet fever	4
Unclassified	65
Total	404

Although the death of the patient must in these cases be attributed to a specific disease rather than to the pregnancy, yet the Committee were impressed by the general lack of facilities for adequate treatment and management during pregnancy and labour of a woman who is seriously ill with intercurrent disease. In heart disease, in pulmonary tuberculosis and in chronic renal disease, it was apparent from the information obtained that there is an urgent need for more institutional accommodation, and the Committee are satisfied that if it were available and used, there would be a considerable reduction in the number of deaths in this group. It is obvious that such institutions would require a medical staff competent in obstetrics as well as general medicine.

CONSIDERATION OF THE "PRIMARY AVOIDABLE FACTOR."

22. The chief object of this extensive investigation is not merely academic, a study of existing clinical results in practical midwifery, but an attempt to find means by which the number of women dying as a result of childbearing may be reduced. Certain facts have already emerged which suggest various directions in which lives might be saved in cases of haemorrhage and toxæmia, but these cases represent only a small percentage of the whole. The Committee have therefore analysed all the cases in Class 1 (deaths directly due to childbearing), with the exception of those due to abortion and ectopic gestation, with a view to ascertaining whether death was inevitable, or might have been avoided in more fortunate circumstances.

23. In this connection the difficulty of correct interpretation by the Committee of the information given in the reports has had to be faced. Certain definite facts contained in them can be understood or explained in only one way, and so far as such facts go there has

been no hesitation in drawing conclusions from them; but the Committee are conscious that as they have been obliged to confine themselves to written documents they may have come to invalid or untenable conclusions in cases where there is possibility of alternative interpretations. They are fully aware of the futility of "arm-chair" criticism and of judgment founded purely upon a report which is possibly incorrect or incomplete. In spite of this reservation they have felt it to be their duty to express an opinion in every case in which the available information, after being carefully considered, appeared to warrant them in doing so. Where the original inquiry has been conducted by an experienced obstetrician, avoidable causes in the management of the case have been pointed out and a remedy suggested in his report. In a few instances causes have been held responsible which in the Committee's opinion were, in reality, of minor importance. In every case the general narrative has been considered as a whole, and it is from this review that conclusions have been formulated.

In many cases several causes contributed to bring about the fatal termination, but the Committee felt that as the object of sound and skilful midwifery is to prevent deviation from the normal rather than to treat the abnormal after it has arisen, information of the greatest value could be obtained by discovering the first point at which such deviation occurred, whether before, during or after the birth of the child. In every case where the information warranted it, a "Primary Avoidable Factor" has been noted in the train of events which led up to the fatal result.

24. In considering these cases the Committee have not had in mind an ideal procedure totally impracticable at the present time in domestic midwifery. They have adopted for convenience a common-sense standard which though arbitrary they consider should be attainable with the present personnel and under existing general social conditions, at any rate in areas within reach of consultant and hospital services. They have asked their investigators, Mr. Gibberd and Mr. Walker, to follow such an agreed standard in analysing the reports. The standard the Committee considered it reasonable to adopt comprised the following conditions:—

(1) The patient should "book" and make arrangements for the confinement, should report any obvious deviation from the normal, and should carry out the instructions of the doctor or midwife.

(2) The patient should receive such ante-natal care from her doctor, midwife, hospital or clinic as should lead to the detection of albuminuria, malpresentation or marked disproportion between the foetal head and the mother's pelvis. The examiner should obtain details of previous difficult labours and of serious illnesses.

(3) The confinement should not be undertaken in an entirely unsuitable environment.

(4) Such antiseptic and aseptic precautions as are generally recognised to be necessary should be taken.

(5) A doctor or midwife should be available and should bring to the case a fair average degree of skill, knowledge and attention.

(6) Such hospital, consultant and transport services as are essential should be available, and the doctor should take advantage of them as and when necessary.

(7) A second doctor, acting as anaesthetist, should be obtained in severe cases.

(8) The hospitals should provide suitable facilities and their officers show evidence of special skill.

This does not seem to be an unduly high standard, though it must be admitted that the facilities here set out are not available for all patients in all parts of the country at the present time.

25. In order to make it clear what this "primary avoidable factor" means, hypothetical examples may be suggested. For instance, a doctor may discover albumin in the urine and prescribe adequate treatment; the patient may fail to follow his instructions and develop eclampsia. Whether the doctor's treatment of the eclampsia is entirely adequate or not, the "primary avoidable factor" is the failure of the patient to carry out the instructions given, since had she done so eclampsia would probably not have supervened. Or again, a woman may die from sepsis following complicated labour; the complication might have been avoided by efficient ante-natal care which was not in fact given. The question here is not the efficacy of the method by which the complication was treated in hospital, but the failure of the person, or persons, responsible for the ante-natal care to foresee the complication which ended in a difficult delivery, and the "primary avoidable factor" is inadequate ante-natal supervision. It will therefore be seen that the classification has regard only to the primary apparent error in management, i.e., if the patient had a serious pathological condition which ought to have been discovered ante-natally and also an accoucheur whose management of the case showed departure from established practice, the death is grouped only under the pre-natal avoidable condition and not under the mismanagement of labour.

26. In summarising the conclusions with regard to the primary avoidable factor, the Committee have been forced to use a numerical method because it seems to be the only one that lends itself to the task, and not because they think there is anything approaching mathematical accuracy in their conclusions. They are anxious to emphasise that wherever a figure is quoted in the following summary, it is meant to be a convenient index of a matter of opinion, rather than a precise observation on a mathematical certainty.

The Committee recognise their disadvantage in having no control series of cases in which the practices they have deemed undesirable have occurred without fatal result, but it is considered that the good results obtained in many general medical practices in which the standard has been in accord with that used in this investigation provide

a not unreasonable comparative series, and justify them in drawing the conclusion that the avoidable factor selected has had a direct causal relationship to the death.*

27. Bearing in mind these limiting conditions and circumstances the Committee have made a broad general analysis of the deaths due to pregnancy or childbearing with a view to the discovery of a "primary avoidable factor," with the following result:—

Group 1.	Cases showing a Primary Avoidable Factor	...	...	626
Group 2.	Cases in which no departure from established practice having a causal relationship to the death has been found	...	...	660
Group 3.	Cases not strictly relevant to this part of the investigation, viz., Abortion and Extra-uterine Gestation	...	...	183
Group 4.	Cases in which the information was insufficient	...	...	122
Total (see page 13)				1,596

In other words the Committee find as a result of inquiry into these deaths that in 39 per cent. of the total number occurring as the direct result of childbirth the data obtainable indicate a primary avoidable cause. When the "irrelevant" cases and the cases with insufficient information are excluded the net percentage of preventable deaths is as high as 43.

Group I.—The Primary Avoidable Factors.

The primary avoidable factors have been sub-divided under four headings:—

- A. Omission or inadequacy of ante-natal examination.
- B. Error of judgment in the management of the case.
- C. Lack of reasonable facilities.
- D. Negligence of the patient or her friends.

A.—Omission or Inadequacy of Ante-natal Examination.

28. Under this class are included both cases in which no ante-natal examination was made, and cases in which examination failed to discover an abnormality which certainly should have been detected. The Committee have limited this group to cases showing complete absence of any ante-natal care, failure to make routine examinations of the urine, failure to enquire into a bad obstetric history, failure to diagnose well-marked disproportion or malpresentation, and failure to follow up abnormal cases already diagnosed. Appreciating the difficulties of ante-natal diagnosis, the Committee have placed in this class very few cases of malpresentation or minor degrees of disproportion even though these might have been present when the examination was made.

The investigators have found it more difficult to obtain information about the nature of the ante-natal care than about the subsequent history of the case, and it is probable that the numbers in this group are underestimated. From the information available it

* See p. 106, footnote.

appears that in most of the instances of complete absence of any ante-natal care the responsibility rested on the patient. There is still a large section of the population that does not realise the advantages of obtaining competent pre-natal advice or recommendation.

But it is also evident that the quality of the supervision given leaves a good deal to be desired. This is not surprising, as it is only within the last few years that any close attention has been paid to the supervision of pregnancy, and the majority of doctors and midwives have had little or no systematic training in this branch of midwifery. Even those who are now most alive to its value realise that we are only beginning to understand the full implication of "ante-natal care." Therefore, although some degree of ante-natal care is given to the majority of pregnant women, the general position is far from satisfactory.

On the other hand, the number of patients who receive some supervision is undoubtedly very much larger than it was a few years ago, and it is most encouraging to note that not a few patients were evidently carefully and systematically observed throughout pregnancy. It is certain that the practice of ante-natal observation is increasing, and that the quality of the supervision given is steadily improving.

29. It is not enough, however, to provide an ante-natal clinic and make the patient welcome when she comes. She needs, as already explained, not only effective examination repeated sufficiently often, but also systematic following-up to ensure regular attendance, and inquiry into the home conditions to ascertain that the woman will be delivered in cleanly circumstances, is properly nourished, and is not suffering from undue physical fatigue.

30. The following are examples of ante-natal supervision which, for various reasons, was ineffective.

Primipara; four examinations by the midwife and six attendances at the Ante-Natal Clinic failed to detect disproportion between the head and the pelvis. Labour was obstructed, craniotomy was performed after much manipulation and the patient died of sepsis.

Patient paid a visit to her doctor, who made no abdominal examination, and went three times to an Ante-natal Clinic where examination failed to detect disproportion. She had difficult labour with unsuccessful attempts at forceps delivery and much consequent laceration. She died of shock.

A primipara of 36, very stout. She attended the Ante-natal Clinic twice, was regarded as likely to be a difficult case and asked to come again. She did not do so and apparently was not followed up by the Clinic. No proper preparations were made for the labour and she died of puerperal sepsis following difficult delivery.

Primipara aged 20, attended the Ante-natal Clinic once, "heart trouble and pleurisy" being noted. She failed to return and was not followed up. She booked a midwife and was not seen again until labour set in three months later. She collapsed four hours after delivery and died of syncope.

31. Other reports show a failure or refusal to take advantage of available facilities for assistance, or in which advice was given but

no steps taken to see that it was followed out satisfactorily. For example:—

Woman of 34 in her second pregnancy had had a difficult forceps delivery five years previously. The midwife apparently suggested that she should attend the Ante-natal Clinic, but the patient refused to go. The midwife did not then insist upon the engagement of a doctor, although she realised that there was probably a contracted pelvis. The patient was admitted to hospital in labour as an emergency case and found to have a ruptured uterus.

Fourth pregnancy, woman aged 33, with three living children. Was destitute and suffering from extreme under nourishment. She refused to go to an Ante-natal Clinic or to take advantage of free dinners. She developed influenza eight days before her confinement and died of exhaustion.

Patient living under very bad conditions had been ill for a long time with bronchitis, for which she had had no special treatment. She was delivered by a midwife and developed pyrexia. The doctor was not called until the fifth day, when the patient was so ill that she died in the ambulance on the way to hospital.

32. Faulty ante-natal care was considered to be the primary avoidable factor in 226 of the 626 cases in Group I. (36 per cent.). In 157 of these cases the doctor or midwife responsible for the care of the patient had failed to make any ante-natal examination at all or the patient had given them no opportunity to do so. And in 69 others ante-natal examination failed to detect a gross abnormality which must have been present. These cases are set out in the following tables (A. and B.):—

* TABLE A.		* TABLE B.	
<i>Absence of Ante-Natal Examination:—</i>		<i>Failure of Ante-Natal Examination to detect an abnormality:—</i>	
The doctor was responsible in	28	Examination by Doctor	... 37
" midwife	20	" Midwife	... 13
" patient	109	" " Clinic or Hospital	... 19
	<hr/> 157 <hr/>		<hr/> 69 <hr/>

B. Error of Judgment.

33. In this matter the Committee's problem is indeed a difficult one. In a certain number of reports the individual doctor or midwife concerned frankly states that in the emergency the wrong thing was done; in others, that in spite of certain treatment (which was in the Committee's view obviously wrong) the patient died. Examples of such cases are rapid extraction in placenta praevia when the patient was suffering from shock and haemorrhage, or a hurried forceps delivery through a partially dilated cervix on account of maternal or foetal distress. In other cases a midwife may have failed to diagnose a serious complication as early as she ought reasonably to have done.

*The reader is reminded that these Tables do not represent the total number of cases in which ante-natal care was deficient, but only those in which its absence was considered to be a primary avoidable factor.

Many errors of judgment are to be found in the reports which bear little or no reference to the event of death, and have therefore not been ascribed as a primary avoidable factor. For instance, avoidable complications may not have been diagnosed or unnecessary interference may have been undertaken in cases which died of pulmonary embolism, though no connection could be traced between these errors and the occurrence of embolism. Under this group are included the very few cases in which there is evidence of gross carelessness.

34. The greatest number of errors which had a direct bearing on the fatal termination of the case were naturally attributed to doctors, as on them rests the ultimate responsibility for all conditions showing a departure from normal. For this reason it is recognised that deductions based upon a comparison of mortality rates in the practice of doctors and midwives respectively may be entirely misleading. Not only is the midwife obliged in all abnormal cases to send for medical aid, but she is also bound by her rules to refuse to undertake alone a case in which, from the history or from some other indication, abnormality appears probable. Thus the midwife has not the same opportunity of exercising an independent judgment, and can always call for assistance when in doubt. It should be added that the 57 cases where the fatal termination is considered to be due primarily to error of judgment on the part of the midwife were almost entirely cases of contravention of her rules. These errors brought her under the jurisdiction of the Local Supervising Authority, which has, as a rule, already dealt with the offence. The small remainder were nearly all examples of gross ignorance, and the midwife was usually found to be much too old for her work.

35. The errors attributed to doctors occurred chiefly in domiciliary practice, though there were a few clear instances of mismanagement of cases admitted to hospital. In this connection regard should be paid to the handicaps under which the general practitioner works in obstetric cases. He is expected to deal with the patient under circumstances which may be reasonably satisfactory for normal delivery, but which are totally inadequate in respect of suitable surroundings, equipment and skilled assistance if and when serious complications arise. The need for specialist help, for trained nursing and for hospital treatment in obstetrics is not so generally recognised as it is for surgical operations either by the professional attendant or by the patient and her friends, and the practitioner has for long acquiesced more or less unwillingly in this unsatisfactory position. Surprisingly good results are often obtained in untoward circumstances, but not infrequently the doctor attempts the impossible, and the case ends in a tragedy. Again, unless labour is relatively rapid, he may find himself pressed by the patient and her relatives to expedite delivery, other urgent work may be awaiting him, and there is often a strong temptation to hasten the case, even though he may be conscious that in so doing a greater or less degree of departure from the path of sound midwifery is entailed.

In nearly one-third of the cases classed as errors of judgment on the part of the doctor, the mistake was premature application of the forceps. In many of these delivery was not effected, and the patient was ultimately sent to hospital where incomplete dilatation of the cervix or disproportion was usually found to be present. Other examples of common error are failure to treat a toxæmia of pregnancy, and the neglect of early warning hæmorrhage in placenta prævia.

36. Error of judgment on the part of the doctor or midwife or hospital was assigned as the primary avoidable factor leading up to the death of the patient in 224 cases (35·7 per cent. of the group of 626 cases), and these cases are analysed in the following table:—

TABLE C.

<i>Errors of Judgment.</i>	<i>Doctor.</i>	<i>Hosp.</i>	<i>Midwife.</i>	<i>Total.</i>
1. Treatment of severe toxæmias of pregnancy faulty or absent	27	9	7	43
2. Neglect of warning hæmorrhages	17	2	5	24
3. Improper use of forceps	41	4	—	45
4. Faulty treatment of third stage of labour	16	2	9	27
5. Non-recognition of obstructed labour	8	2	10	20
6. Gross errors in the prevention or recognition of sepsis	7	2	14	23
7. Miscellaneous	30	—	12	42
Total	146	21	57	224

C. Lack of Reasonable Facilities.

37. In this class are included cases in which the absence of skilled assistance was the primary cause in the death, cases conducted in abnormal surroundings such as delivery in a cowshed, instances of women living in remote and isolated situations and one or two examples of extreme overcrowding. Poverty and uncleanness, although unfortunate accessory factors, have not, so far as can be ascertained from the reports, borne any direct relation to these deaths.

Lack of reasonable facilities was considered to be the primary avoidable factor in 64 cases. From an examination of the returns, it appeared that only a few of the deaths could be attributed to difficulty in obtaining medical assistance of some sort. In 26 cases it was thought that the most important factor leading to the fatal issue was absence of a second doctor to give an anaesthetic. In 13 cases it seemed probable that if the doctor had had a trained assistant, instead of having to rely in a difficulty upon the inadequate help of a totally incompetent relative or friend, the result would have been different. In 25 deaths it was considered that the most important cause leading up to the death lay in the bad surroundings under which the patient was confined.

Absence of hospital beds and of consultant services had undoubtedly been responsible for death in many cases, but the Committee have found it impossible to express this numerically. They are

nevertheless impressed with the urgent need for increased institutional facilities, and consider that this is one of the most important ways in which improvement will be made possible.

D. Negligence of the Patient and Her Friends.

38. This accounts for a considerable number of the cases showing a primary avoidable factor. The negligence usually took the form of failing to follow the doctor's advice, or ignoring signs and symptoms of obvious and serious illness.

In 112 deaths the Committee considered that the most important cause leading up to the death was absence of sensible co-operation on the part of the patient—in the majority of cases amounting to deliberate refusal to carry out advice or to take any reasonable steps to obtain help. In addition to these, there were 109 patients who failed, presumably through ignorance, to submit themselves to antenatal examination, and these have been included under heading A.

Group 2.—Cases Where no Avoidable Cause has been Detected.

39. There remain 660 deaths, in some of which there was nothing definite in the report to show that the woman had not received attention in accord with the standard laid down above, while in others the failure to attain the standard had no apparent causal relation to the fatal termination. It should be noted that in a large number of cases failure of the Committee to discover an avoidable cause is probably due to deficient information rather than to the absence of such a cause, and that fuller reports following a more searching investigation might have led to the inclusion of many of these cases in Group 1. For example, in many there are no precise details as to the antiseptic technique followed, the general management of the delivery or the management of the third stage of labour.

With regard to some cases included in this group, increased knowledge and research may show the importance of causes at present not realised, while in yet others improved training of medical students and midwives may lead to a higher standard of technique than that postulated in the present enquiry. There is a small residuum in which the fatal result appears to have been due to an unfortunate train of circumstances which reasonable skill and care could hardly prevent.

TABLE IV.

Table Summarising the Findings in this Chapter.

	No evidence of departure from established practice.	Lack or failure of ante-natal care.	Error of judgment.	Lack of facilities.	Negligence of patient.	Total.	Percentage.
Sepsis Normal labour ...	209	1	27	24	12	273	21·2
Sepsis Low forceps ...	33	1	2	10	—	46	3·6
Sepsis Complicated labour	98	67	57	15	13	250	19·5
Ante-Partum Haemorrhage ...	26	5	31	1	22	85	6·6
Post-Partum Haemorrhage ...	54	7	20	6	20	107	8·3
Shock ...	44	43	28	7	8	130	10·1
Eclampsia...	54	90	40	1	23	208	16·2
Other Toxaemias...	50	8	16	—	7	81	6·3
Embolism ...	92	4	3	—	7	106	8·2
TOTAL ...	660	226	224	64	112	1,286	
Percentage ...	51·3	17·6	17·4	5·0	8·7		100

TABLE VII.

Original booking and ultimate method of delivery of patients.†

—		Sepsis.	P.P.H.	A.P.H.	Operative Shock, etc.	Eclampsia.	Other Toxæmas.	Embolism.	Total
Original Booking:	Hospital ...	74	5	11	27	23	13	21	174
	Doctor ...	216	39	31	58	72	25	37	478
	Midwife ...	242	34	49	39	64	8	34	470
	Not booked	57	12	26	10	44	21	13	183
	Unstated ...	27	2	8	11	15	32	8	103
Total ...	616	92	125	145	218	99	113	1,408	
Ultimate Delivery:	Hospital B†	79	6	13	28	23	13	21	183
	" E	64	9	65	45	89	32	12	316
	Doctor ...	278	62	37	59	60	15	44	555
	Midwife ...	158	11	—	7	7	4	25	212
	Undelivered	—	—	10	2	39	9	1	61
	Unstated ...	29	1	—	4	—	26	7	67
	No Attendant* ...	8	3	—	—	—	—	3	14
Total ...	616	92	125	145	218	99	113	1,408	

Total number of cases investigated, 2,000.

1408 cases are included in the above table—there were also 188 cases of abortion and ectopic gestation, and 404 cases which died from intercurrent diseases.

Conclusions.

40. It is clear from what has been already said that caution must be exercised in drawing conclusions from the evidence obtained from these investigations. The Committee are, however, convinced that information has been elicited which is of substantial and definite

* This means that no preparation had been made for the confinement, and that no doctor or midwife was present during labour. It does not include cases born before the arrival of the attendant.

† B = Booked case.

E = Emergency case.

‡ The explanation of the discrepancy between the number booked by a hospital and the number entered as delivered in hospital as booked cases is that a certain number of cases booked by a doctor were seen in hospital ante-natally at the request of the doctor. Although later sent in as emergencies, the hospital staff had had the opportunity of diagnosing any deviation from the normal.

value in indicating practicable lines of action towards a reduction of the maternal death rate.

41. Ante-natal supervision is now recognised as an essential part of the care of pregnant women, and yet from a study of the maternal death returns, it is seen that there are still numbers of women who die as a direct result of its omission. In a large proportion the neglect has occurred through ignorance or prejudice on the part of the patient, and this can be overcome only by that more enlightened outlook which must be obtained in the future. In some the neglect has been due to failure on the part of the doctor or the midwife to appreciate the necessity for ante-natal supervision in every case, though when it is realised that fifteen years ago ante-natal care on a large scale was hardly practised at all, it is not surprising that there are still doctors and midwives who do not realise its importance. Improvements in medical education and in the training of midwives that have taken place in the last few years, together with improvements that may be looked for in the future, will do much to reduce the number of women who are allowed to go through pregnancy uncared for, and the Committee's investigations afford ground for hope that this change will be reflected in a reduction in maternal mortality.

While emphasising the extreme importance of ante-natal examinations, the Committee have found evidence of a certain amount of inefficient work which has passed under the guise of "ante-natal care." They consider that adequate and satisfactory ante-natal care requires as much experience, as much skill and as much diligence as operative midwifery itself, and that every effort should be made to secure effective medical supervision by competent medical practitioners in close touch with actual obstetric work.

42. Not only have the Committee found evidence of neglect in ante-natal diagnosis, but also to a great extent in ante-natal treatment. In many instances where some abnormality has been discovered during pregnancy, the treatment has left much to be desired, and this failure to treat a patient has largely been due to lack of facilities. There is ample evidence of the difficulty of obtaining hospital accommodation for diseases of pregnancy, and the Committee think that great benefit would follow an increase in the number of beds available for such cases in institutions. In some instances the lack of treatment has been the result of social conditions or circumstances which, to the patient, rendered her presence in her own home imperative, so that treatment, though advised, was not carried out. In a few the seriousness of the abnormality was not appreciated by the doctor or midwife and no attempt was made to advise adequate treatment. Improvement in domestic environment and in the education of midwives and doctors must be looked to as a remedy for such cases.

43. In relation to serious complications and accidents of labour, whether or not they might have been foreseen and averted by ante-natal care, the Committee have ample proof of the need for a higher

standard of knowledge and skill on the part of the general practitioner, as well as for the provision of consultant services and of an increased number of readily available hospital beds. Many cases of labour showing mechanical difficulties might have been treated with greater hope of success in a well-equipped hospital. The question of transport of the patient during labour, although important, does not seem to have been often at fault, since, except in rare instances in rural areas, there is little evidence pointing to difficulties in transport. The urgent case which cannot be moved to hospital without aggravation of risk is bound to occur from time to time, and no further improvements in an already good transport service can possibly make up for the lack of expert domiciliary service in certain conditions, especially in post-partum haemorrhage, and occasionally in ante-partum haemorrhage.

44. Amongst the deaths from haemorrhage a number of patients might have been saved had specialist services (including facilities for blood transfusion) been at hand. It is suggested that one or more emergency blood transfusion units might be organised and ready in every large town, with a rota of donors available at short notice, and a personnel trained in modern methods. Such an organisation should be regarded as part of the normal and necessary provision in large maternity hospitals. At the same time it must not be lost sight of that the majority of cases of haemorrhage and obstetric shock can be saved from death by the immediate replacement of fluid by intravenous or subcutaneous saline solution or other suitable fluid. The giving of saline solution by rectum may be effective in mild cases, but the fluid is not absorbed by the bowel in case of severe collapse. The Committee regard, therefore, the extended provision of these services as an essential part of any measures taken for the improvement of midwifery work.

45. The Committee have paid special attention to the circumstances leading up to death in cases of sepsis, and they are encouraged to look for substantial improvement in the number of deaths from sepsis following abnormal labour. It seems to them a reasonable hope that as ante-natal diagnosis becomes more widespread and efficient, as specialist domiciliary service becomes more easily obtainable, and as institutional treatment for abnormal cases becomes more accessible the amount of difficult midwifery performed under unsuitable conditions will steadily decrease, and as a result the number of deaths from sepsis in this group will decrease also.

On the other hand, the number of deaths from sepsis following "normal labour" demands intensive investigation. Though sporadic cases account for by far the greater proportion of the deaths from sepsis as reviewed by the Committee, a small number have occurred in epidemics, and to this problem the Committee have given special attention both from the clinical and bacteriological point of view. in another portion of their report. It is probable, however, that epidemic sepsis accounts for a greater number, and sporadic sepsis for a smaller number, of deaths than was revealed in this investigation.

Failure in efficient antiseptic technique probably accounts for a considerable number of these cases. Further reference is made to this matter in Chapter IV.

Some Social Aspects of the Inquiry.

46. After considering in detail the causes and significance of maternal mortality as revealed in the reports submitted on individual cases, it may be interesting to examine, without drawing statistical inferences, certain general points in connection with these cases.

Age of Death.

The figures support the common experience that the burden of mortality falls most heavily upon the younger women, and mainly upon those of 25 to 35 years of age. 1,463 women were under 35 years of age—that is, 71 per cent. of the total. No less than 455, or 23 per cent., were aged 25 or less.

The *social circumstances* naturally vary considerably. The information given is limited, as the conditions under which the inquiries were carried out were scarcely appropriate for any detailed investigation of such matters. Moreover, the terms “well-to-do,” “poor,” etc., are necessarily somewhat differently interpreted by the various observers. But it is of interest to note that more than half the patients—namely, 1,256—were described as “well-to-do” or living in good working-class homes, and that only 439 were classified as “poor.” In addition, there were 120 “destitute” cases, most of them in receipt of poor relief or unemployment benefit, and some of them living under extremely dirty and insanitary conditions. No information on this point is available in the remaining cases.

First Pregnancy.

47. Of the total, 758 were primiparae, and a number of others concerning whom no information as to previous pregnancies was given, were probably primiparae also. A certain number of the women pregnant for the second time (351) experienced their first labour, the first pregnancy having terminated in abortion.

The ages of the primiparae were as follows:—

14-20 years	...	...	...	...	...	101
21-25	„	...	...	...	...	227
26-30	„	...	...	...	...	229
31-35	„	...	...	...	...	133
36-45	„	...	...	...	...	61
No information	...	...	...	...	...	7

758

The causation of death was noted in an unselected sample of 476 consecutive reports on death among primiparae, and is as follows:—

	Per cent.
Puerperal sepsis (including 13 following abortion)	252 = 53
Eclampsia, toxæmia, nephritis, etc.	75 = 16
Embolism	28 = 6
Haemorrhage	26 = 5
Difficult labour	24 = 5
Pneumonia, etc.	22 = 5
Morbus cordis	21 = 4
Syncope, shock following labour, etc.	15 = 3
Miscellaneous	13 = 3
	476

Puerperal sepsis is obviously the outstanding cause of death and accounted for 53 per cent. of the total; eclampsia and toxæmia come next in order of importance (16 per cent.). Both of these are largely preventable conditions, and the exercise of wise care during pregnancy should materially reduce deaths under other headings. Deaths from morbus cordis seemed almost always due to pregnancy supervening upon a rheumatic infection of the heart, little, if any, special care having been taken to protect the heart from undue strain.

48. It may be interesting to compare with this the causes of death among women who have already borne many children. The following figures refer to 142 multiparae who had all passed through at least 6 pregnancies before the one which terminated fatally:—

	Per cent.
Haemorrhage	39 = 28
Puerperal sepsis (including 3 following abortion)	33 = 24
Eclampsia, toxæmia, etc.	23 = 16
Pneumonia, etc.	15 = 11
Syncope, shock following labour, etc.	9 = 6
Embolism	9 = 6
Difficult labour	5 = 3
Morbus cordis	5 = 3
Miscellaneous	4 = 3
	142

Among these women haemorrhage emerges as the principal cause of death, followed by puerperal sepsis. It is somewhat surprising to find that eclampsia, toxæmia, etc., occurs as frequently in this group as among the primiparae, namely in 16 per cent. of the total.

49. *Women who have already had many children* are often particularly in need of something more than the ordinary ante-natal supervision which should be sufficient for the younger mother, yet it is just these patients with whom it is often exceptionally difficult to get in touch. Poverty is naturally more frequent and more acute

among them because of the large family, and for the same reason living conditions are apt to be overcrowded and less sanitary. If the mother is in reasonably good health she is apt to neglect preparations for the confinement because she is busy with household duties, she has been through it so often before, or she has no time to bother with visits to the doctor or midwife. Often she is weary, under-nourished, dispirited, and thus even more inclined to let matters slide and hope that all will be well.

For example:—

Thirteenth pregnancy with 11 children at home. Home overcrowded, mother overworked and suffering from severe pyorrhoea. She gave birth to a macerated foetus and died of puerperal sepsis.

Eleventh pregnancy, aged 40, had no ante-natal care, and made no preparation in spite of severe oedema of the legs. When the doctor was sent for he found the baby born and the woman in a state of extreme collapse, under-nourished, and unable to respond to treatment. She died of puerperal sepsis.

Ninth pregnancy, the mother very poor and in receipt of parish relief. Suffering from fatigue and overwork due to a large young family. She died of post-partum haemorrhage.

Tenth pregnancy, wife of a labourer with eight children at home. No preparation was made for the confinement, and the mother was working as a dressmaker to help support the home until the end of pregnancy. She had an attack of influenza a fortnight before her confinement and was then in a state of extreme exhaustion owing to illness and overwork. She died of "asthenia."

If advice is, in fact, sought, there is an unfortunate tendency to slur over ante-natal examination because previous successful deliveries are thought to make this less necessary and thus complications are not infrequently overlooked which more careful enquiry might reveal. The number of deaths from eclampsia, difficult labour and sepsis illustrate this. Therefore it is not only important to give every encouragement to these tired mothers to seek assistance, but also to ensure that the advice given is sound and that particular attention is paid to the social conditions and to the possible need for nourishment, rest or domestic assistance during pregnancy as well as at the time of confinement.

50. The possible effect of malnutrition on the developing child must also not be overlooked. Although, generally speaking, the child thrives at the expense of the mother, it has been suggested that under-nourishment in the mother may lead to constitutional defects in the child and in particular to a rickety tendency which may give rise in a girl to subsequent pelvic deformity among other conditions.

51. It may also be of interest to consider the maternal mortality in relation to *unmarried women* as these are subject to adverse conditions which obtain less often among married mothers. 102 reports deal with women unmarried at the time of delivery, the great majority being primiparae. Two of these women were under fifteen years of age, 33 were under twenty, and 33 under twenty-five.

The main causes of death among the 102 unmarried mothers were as follows:—

Abortion—15. In 9 of these there was no ante-natal attention. Inquests were held in 5 cases and 3 were regarded as probably criminal in character. Eleven of the women died from sepsis, 2 from toxæmia, 1 from hæmorrhage and 1 from mania.

Puerperal Sepsis—23. There was no ante-natal care in 12 of these. Seventeen followed normal labour (3 in hospital). In one of these the girl was confined in a hovel, 2 were delivered under dirty, insanitary conditions, and 2 were complicated by pneumonia. Of the other cases, in 2 the baby was born under very unsatisfactory conditions before arrival of the attendant; in 1 manual removal of the placenta was necessary; there was 1 case of placenta prævia, another of toxæmia; 1 woman suffered from gonorrhoea; and in another there was a question of scarlet fever.

Eclampsia—20. In 13 there had been no ante-natal care. Two of the patients were elderly primiparae aged 40 and 44. One woman suffered from heart disease.

Uraemia, Toxaemia, etc.—6. Two patients had had no ante-natal care; 1 was delivered under "filthy" conditions. The remaining 3 were treated in hospital.

Difficult labour—12. Four died after Caesarean section, 3 being emergency cases with no ante-natal supervision. Three died after craniotomy (no ante-natal care); 1 in a nursing home after a difficult forceps delivery; 1 of shock following manual removal of the placenta by an unassisted doctor; and 3 from exhaustion following labour.

Haemorrhage—9. Four died from ante-partum hæmorrhage; 4 from post-partum hæmorrhage; and 1 from both ante- and post-partum hæmorrhage. There was an inquest in the case of 1 of the patients who was found dead.

Mania—4. One followed puerperal fever, another followed chorea, and another toxic vomiting.

In addition to the above, 3 patients died of tuberculosis; 5 from heart disease (1 was found dead, and 1 was destitute and neglected); 2 followed influenza, 1 of these being a fourth illegitimate pregnancy in an insanitary and dirty house.

52. A study of the general conditions associated with these deaths leaves the impression that single women, as might be expected, suffer greater hardships and run greater risks during pregnancy and at the time of confinement than married women. The natural desire to conceal the pregnancy as long as possible frequently prevents the mother from seeking ante-natal advice or from making preparations for the safe conduct of her confinement. It is difficult to see how these additional burdens can be lightened except through the operation of social measures designed to assist the single woman in the time of her need, and to encourage her to seek advice and guidance early rather than to put off as long as possible the ordeal of informing her family or obtaining professional attention.

53. It is possible that *mental stress, anxiety or worry* may have a detrimental effect upon the patient's condition during her confinement, as well as in rendering her difficult to influence and unresponsive to suggestions made during pregnancy. Such psychological reaction is naturally most likely to be observed when the circumstances surrounding pregnancy are not entirely straightforward, as,

for example, in the case of single women; but undue fear or anxiety may be a result of warnings or advice which are not fully understood or which receive an exaggerated interpretation, and this is a point which should not be overlooked in connection with propaganda or efforts to impress upon public opinion the importance of taking steps to prevent disaster at the time of childbirth. For example:—

A woman aged 32 in her seventh pregnancy had had an adherent placenta on two occasions and was un-nerved by the death of a neighbour at the time of childbirth. She developed some puerperal sepsis after delivery, but was too terrified to be willing to go to hospital for treatment and could not be persuaded to do so until it was too late for treatment to be effective.

54. The *patient's own home* is in ordinary circumstances a safe place for a normal confinement even under the usual conditions of working-class life, but a dirty condition, whether of the patient herself, her house, or her general surroundings may predispose to septic infection even in a straightforward labour, and is even more likely to do so when any complication arises.

A woman made no preparations and the baby was born before the arrival of the midwife. When the midwife was obtained she found the woman personally dirty and neglected and in very unclean surroundings. She died of puerperal sepsis.

Fifth pregnancy; the patient was destitute, living in a tumbledown cottage, very dirty and sparsely furnished. She herself was unclean, and the children were neglected and suffering from scabies. She had suffered from haemorrhage during the last month, but took no notice of it. When, after some delay, the doctor was obtained on account of a very severe haemorrhage, no preparations for the confinement had been made. The patient was eventually admitted to hospital and died of sepsis following placenta praevia.

The patient had suffered from an ischio-rectal abscess eight months previously. She was weak and debilitated with a foul vaginal discharge at the time of birth. The bed and surroundings were very dirty. She had made no suitable preparations for the confinement, and died of puerperal fever and embolism following normal delivery.

The patient had had septic teeth and a verminous head; there had been no ante-natal care beyond an examination by the midwife at the seventh month. The patient was delivered in a very dirty home, and, although labour was normal, subsequently developed fatal sepsis.

55. Even now some women still undergo confinement in *remote districts* so far from doctor or nurse that skilled attention is difficult to secure in time of need. For example:—

The patient lived in an inaccessible place in an area not served by a district nurse. No midwife was available and the patient had haemorrhage for 14 hours before a doctor could be got. There was some septic infection afterwards, but in the doctor's opinion she died mainly as a result of weakness and exhaustion and of endeavouring to move about the house and help herself while in an exceedingly debilitated condition.

The number of district nursing associations in the country has steadily increased until there are now few areas where no nurse can be obtained; but these still exist, and when the dwelling is remote everything possible should be done to persuade the mother to have her baby in a maternity hospital if the domestic conditions can be satisfactorily adjusted.

56. In a few cases the patient died from puerperal fever which can probably be directly attributed to *lack of skilled attention at birth*. For example:—

The woman was attended by a handywoman, and there was delay in securing a doctor as the husband was unwilling to go when asked to do so. The baby was therefore born before the arrival of the doctor, and the woman subsequently developed sepsis.

An unmarried girl of 18 came to her grandmother's house for her confinement. Conditions were unsatisfactory, the house and surroundings dirty, there was no ante-natal care. The doctor was only summoned when labour had commenced. The baby was born before he arrived with only the grandmother present.

Fourth pregnancy, a woman of 33, living in a dirty, overcrowded house with three of her own children and six step-children. She was under-nourished and fatigued. She had not engaged a midwife, and only neighbours were available to assist with the birth. She subsequently died from puerperal sepsis.

57. The patient herself is often her own worst enemy, whether from ignorance or apathy, ill-health or prejudice, etc., and until she is able and willing to co-operate with doctor and nurse, attempts to assist her can never be fully effective.

A multipara with mitral stenosis and in a poor state of nutrition. Would not attend the Ante-Natal Clinic, where she could have been given milk and food, or go to hospital for treatment. She died of heart failure and exhaustion after her confinement, a result which might have been averted by suitable care and treatment.

A patient booked a midwife, who sent her to an Ante-Natal Clinic; albuminuria was found and she was referred for treatment to her private doctor. He advised hospital treatment, but the patient refused to go and it was impossible to carry out effective treatment at home. She died of toxæmia.

A multipara with several illegitimate children. No preparations made for the confinement, no midwife engaged, refused ante-natal assistance. Very poor conditions, not enough coal in the house to get hot water for a hot drink or a spare sheet to cover her.

CHAPTER III.

ABORTION IN RELATION TO MATERNAL MORTALITY.

58. The part played by abortion in the causation of maternal mortality is a matter which has aroused considerable public interest of late. There appears to be a widespread opinion, which has been put before the Committee in evidence and brought to their notice in other ways, that the practice of intentional abortion is greatly on the increase, and that the maintenance of the maternal death rate at its present figure, in spite of all modern improvements in practice and technique, may be largely due, directly or indirectly, to this cause. This is a question to which the Committee have given careful consideration in its medical aspects, but the much larger sociological aspects both of abortion and of birth control, in their mental as well as their physical effects, do not fall within the purview of this inquiry.

59. Evidence on this matter was placed before the Committee by Lord Riddell, who has given much attention to the question from the medico-legal aspect. The primary point which he invited the Committee to consider was whether the maternal mortality rate is substantially affected by an increase in deaths from sepsis or other causes following intentionally induced abortion, such factor being either deliberately concealed or not evident under the present system of death certification.

60. For the purpose of this Report the term "abortion" is defined as the expulsion of a fertilised ovum from the uterus, from any cause, before the twenty-eighth week of pregnancy. This term was formerly restricted to an expulsion occurring before the formation of the placenta at the end of the third month, while "miscarriage" was used to designate one occurring between that date and the twenty-eighth week (the date of viability of the child). The terms are now generally regarded by medical men as synonymous, and the latter term has therefore not been used in this report.

61. Information as to 256 cases of deaths where abortion played a part has been furnished to the Committee among their reports on maternal deaths, but the clinical details obtained are somewhat meagre. These cases have been divided into two classes—those in which abortion was the primary cause of death, and those in which death was due to other causes and the abortion was an incident of secondary importance.

The first class number 168, of which 52 cases came before a Coroner's Court—14 were found to have been criminally induced and 12 to be due to natural causes, while in 26 cases there was an open verdict. Of the 168 cases the immediate cause of death in 143 cases was sepsis; in 19 haemorrhage; in 4, shock; and in 2 unrecorded. It is a notable feature that in 110 out of 151 cases where the point is recorded, that is, in 72·8 per cent., medical advice was not obtained

either until the ovum had been partly or wholly expelled, or until pyrexia had already set in.

Of the remaining 88 cases where death was not primarily due to abortion (which are included in the survey in Chapter II), 30 were associated with toxæmia of pregnancy; 6 with other obstetric complications and 52 with intercurrent diseases. The large proportion of toxæmic cases in this group emphasises the need for beginning ante-natal care early in pregnancy. The Committee note the absence of syphilis, assigned or deduced from reports, as a cause of death from abortion. This is in accordance with the views of most modern authorities, who regard syphilis as a potent cause of premature labour but not of abortion.

62. The question whether there has recently been an increase in the number of cases of abortion, and particularly in those intentionally induced, is one of great complexity, and in its nature hardly admits of an accurate answer. Spontaneous expulsion of the contents of the uterus is relatively common. When it occurs early it may be unobserved or ignored by the individual. Moreover, very slight causes sometimes bring about an abortion, while in other cases serious accidents and mechanical interference, even involving injury to the uterus, may fail to do so. When to the biological aspects are added the problems due to intentional concealment, it is clear that the clinician may find it difficult or impossible in any given case to determine whether an attempt has been made at artificial induction or not. The Committee have therefore found it necessary, in considering the evidence available as to the incidence of abortion, to take the cases as a whole without attempting to discriminate between spontaneous and intentionally induced abortion. Most of the medical witnesses interrogated by the Committee on this point, while without sufficient data to enable them to give a definite statistical opinion, had, notwithstanding, a distinct impression, gathered from their clinical experience, that the practice of intentional induction of abortion is more frequent than formerly.

63. No attempt has been made in this country to obtain an official record of the incidence of abortion, but in certain towns in Germany and Russia a system of notification is in use and the results show a very marked increase during the last few years.

Several series of figures from English Hospital records, which may be sufficiently representative to throw some light on the question, are, however, available. The earliest reliable figures the Committee have been able to find bearing upon this point are those of Whitehead,* who took a careful obstetric history of the patients seeking admission to the Manchester Lying-In-Hospital in the years 1845 and 1846. He found that the proportion of all pregnancies which ended in abortion was 1 to 7. Hegar, as stated in the *Science and Practice of Midwifery* by Playfair, 1884, gave a figure of 1 to

* Abortion and Sterility. Whitehead, 1847.

8 or 10, and Galabin in his *Manual of Midwifery*, 1893, gives 1 to 5. Recently Beckwith Whitehouse* has gone fully into the histories of women attending the Gynaecological Clinic at the Birmingham General Hospital and in his private practice, and has found it, for the period immediately preceding the great war, to be 1 to 5, and for the years following it, 1 to 5.9.

The records of the East End Maternity Hospital have been searched, and it is found that for the years 1897 and 1898 its figures approximate to those of Whitehead and Beckwith Whitehouse. Later years, however, show a decline, which may be due to the greatly improved social conditions obtaining in that district now as compared with thirty years ago, and to the reduction in the size of families which has taken place, possibly combined with the effect of ante-natal and post-natal care.

64. The results set out in the following table, drawn from the obstetric histories of hospital patients, show that on the data available there has been no material increase in recent years and that the proportion of abortions (chiefly in married women of the hospital class) has remained at from 14 to 19 per hundred pregnancies:—

Period.	Place.	No. of women.	Total pregnancies.	No. of abortions.	Percentage of pregnancies ending in abortion.	No. of women who aborted.	Percentage of women who aborted.	Average size of family.
1845 1846	Manchester (Whitehead)	2,000	8,681	Not stated.	14.3	747	37.3	4.3
1897 1898	East End Maternity (Oxley).	898	3,964	623	15.7	334	37.1	4.4
Prior to 1903	†Birmingham (Malins)	4,000	12,127	2,303	18.99	1,461	36.53	3.0
1909 1913	Birmingham (Beckwith Whitehouse).	1,208	6,021	1,067	17.7	511	42.3	5.0
1924 1925	Birmingham (Beckwith Whitehouse).	1,148	3,910	663	16.9	397	34.5	3.4

* Causes of Early Abortion and Sterility. Proceedings of the Roy. Soc. Med., Dec., 1929.

† Journal of the Obs. and Gyn. of the British Empire, Vol. III., April, 1903.

Other figures based on the number of cases admitted to hospital for treatment of abortion have been supplied to the Committee, e.g., from the Jessop Hospital and Firvale Hospital, Sheffield, and from the Edinburgh Royal Maternity Hospital and Simpson Memorial Hospital. The Sheffield figures show an increase of about 25 per cent. in admissions for abortion in 1928 compared with those for 1925. In Edinburgh the proportion of abortions to total deliveries in the Hospital averaged 4.5 per cent. in the years 1905-14 as compared with 6.9 in the years 1923-28. But the social and other causes affecting the number and type of patients admitted to a given Hospital may vary so much at different periods that such figures are probably of little weight. Indeed the Committee are satisfied that all statistical returns as to abortion must be accepted with great reserve.

65. The Registrar-General's returns are available, as to the number of deaths directly due to abortion from year to year, but owing to the method of classification, it is only in the returns since 1926 that the figures are of comparative value. Before that date deaths from septicaemia following abortion (the commonest cause of death) appeared under the general heading of puerperal sepsis and were not differentiated. The deaths from abortion for the three years 1926, 1927 and 1928, which include these cases of septicaemia, are 308, 297 and 301, a percentage of the total maternal deaths of 10.7, 11 and 10.3 respectively. But even these figures do not include deaths from abortion which have been the subject of a Coroner's enquiry, such returns having in the past been entered under suicide, accident, manslaughter or murder, according to the verdict returned. In 1928, however, Coroners' cases were grouped for the first time, and amounted to 57, making a total of 358 recorded deaths from abortion for that year. More complete information will, therefore, be available in future.

66. Another point which has been considered is whether a large number of deaths may now be occurring from abortion in which the death certificates make no mention of this cause. If this were so, the fact that the great majority of known deaths from abortion are due to sepsis would lead one to expect an increase in the percentage of female deaths from general septic diseases and from septic peritonitis. The Registrar-General's figures for the last ten years show no progressive increase in deaths under this heading, but the percentage of deaths from these causes to total female deaths shows a slight increase in the later years, averaging 0.19 for the five years 1919-23 as against 0.26 for the five years 1924-28. The table is given below:—

	Female deaths from "purulent infection, septicaemia."	Percentage to total female deaths.	Female deaths from peritonitis of unstated origin.	Percentage to total female deaths.	Total.	Total Percentage.
1919	177	0-07	255	0-10	432	0-17
1920	244	0-10	263	0-11	507	0-21
1921	232	0-10	230	0-10	462	0-20
1922	198	0-08	278	0-11	476	0-19
1923	188	0-08	265	0-12	453	0-20
1924	203	0-08	231	0-09	434	0-17
1925	253	0-19	270	0-11	523	0-30
1926	254	0-11	264	0-11	518	0-22
1927	267	0-11	246	0-10	513	0-21
1928	287	0-12	260	0-11	547	0-23

67. The indirect effect of intentional abortion, attempted or successful, on maternal mortality is an even more obscure question. The Committee find that there is a widespread belief that such attempts produce a latent sepsis, the results of which, after subsequent delivery at term, or in a later pregnancy, may be disastrous. That serious damage to the health of the mother may follow is well recognised. There may for instance be the occurrence of repeated abortions; or pelvic inflammation may be set up and may lead to chronic invalidism and permanent sterility; or serious damage to liver and kidneys may be produced by certain chemical abortifacients. In the considered opinion of the Committee, however, there is no evidence to show that if a pregnancy goes to term after an unsuccessful attempt to terminate it, there is increased risk in delivery, nor that a patient who has successfully induced abortion in a previous pregnancy is in greater danger of sepsis in a subsequent pregnancy. A similar suggestion as to remote ill-effects has been made in relation to the use of contraceptives. Here again the Committee recognise that occasional harmful results from inflammation may be set up by mechanical or chemical agents, but apart from this fact they can find no evidence that a subsequent pregnancy and puerperium is less likely to run a normal course than in other cases.

68. The desirability of more active measures being taken to stop the sale of abortifacients was brought to the notice of the Committee in the evidence given by the Midwives Institute. Their representatives stated that it was the experience of practising midwives in different parts of the country that abortifacients were readily obtainable, and frequently taken, with or without result. The recent action of the Advertising Association in persuading the Press and advertising agents to refuse advertisements, veiled or otherwise, of such drugs is stated to have had good effect. The Committee have been informed that what is needed is not so much an alteration in the law as its more appropriate application. Under the "Offences Against the Person Act, 1861," Sections 58 and 59, action can be

taken against anyone who administers, supplies or procures any poison or noxious thing with intent to produce the miscarriage of a woman. The difficulty is to prove that such goods were sold or supplied for the purpose of producing a miscarriage. The effect, in stopping the use of lead pills, of the Order in Council, April 27th, 1917, adding lead in combination with certain fatty acids to the Schedule of Poisons under the Poisons and Pharmacy Act, 1908, is said to be satisfactory, but the non-inclusion of machine-spread diachylon plaster in the Order leaves a possible means of obtaining this drug to which the Committee's attention has been drawn.

69. The general conclusion of the Committee is that while there can be no doubt that abortion plays a serious and regrettable part in the production of puerperal sepsis, and therefore in the causation of maternal morbidity and death, they are unable to find evidence to support the opinion that an increase of deaths from abortion, of sufficient magnitude materially to affect the maternal death rate, has taken place in recent years. They are, however, of opinion, both from their experience and from consideration of the reports, that provision for the treatment of cases of abortion is inadequate and that not only maternal mortality but morbidity from this cause is considerably affected by the lack of hospital accommodation and of skilled and early treatment, aggravated in many instances by the woman's concealment of her condition, or lack of appreciation of the seriousness of her symptoms, until it is too late.

CHAPTER IV.

PUERPERAL SEPSIS.

70. The prominent part played by puerperal sepsis in the causation of maternal death and disability render its close consideration one of the most important duties of the Committee. The field of enquiry is wide, ranging from large problems of scientific research to questions of administrative action and clinical methods. The Committee propose to reserve for their final Report certain formulated conclusions and recommendations on this subject, but have included in their Interim Report some general points and some considerations arising out of their maternal death enquiry.

Administrative Aspect.

71. Puerperal fever was made a notifiable disease under the Infectious Diseases (Notification) Act of 1889. The value of notification, in addition to the collection of statistical information, is to enable the Public Health Department of the Local Authority to take measures against spread of infection, and, where necessary, to ensure suitable arrangements for treatment. The Act of 1889 contained, however, no definition of the conditions covered by the term "Puerperal Fever," and notification was imperfectly carried out.

After the issue of the Report on Maternal Mortality by Dame Janet Campbell in 1924,* and the discussions of the Obstetric Conference held in London in 1925, the desirability of further information and improved opportunity for action became evident. In 1926 Puerperal Pyrexia (defined as "any febrile condition . . . occurring in a woman within 21 days after childbirth or miscarriage in which a temperature of 100·4 deg. F. (38 deg. C) or more has been sustained during a period of 24 hours or has recurred during that period") was added to the list of notifiable diseases by the Public Health (Notification of Puerperal Fever and Puerperal Pyrexia) Regulations, 1926. This definition was adopted by the Ministry of Health after consultation with the Royal Society of Medicine, and it was hoped that by the notification of a number of more or less obscure pyrexial conditions following delivery, the risk to other patients from unrecognised septic infections would be diminished.

72. In order to give practical value to these Regulations, the practitioner notifying the disease was invited to state whether facilities were available for all necessary treatment, or whether he desired further assistance in the form of a consultant's opinion, hospital provision, domiciliary nursing or bacteriological examination. At the same time a circular was issued by the Ministry of Health to Local Authorities authorising them to include under their Maternity and Child Welfare Schemes provision of these services for patients who were unable to make suitable arrangements for themselves.

* No. 25 of Reports on Public Health and Medical Subjects issued by the Ministry of Health, 1924.

Many Local Authorities have made such provision, and the Committee are officially informed that at the end of March, 1930, out of 428 Local Authorities carrying out Maternity and Child Welfare Schemes, 224 have made institutional provision for cases of Puerperal Fever and Puerperal Pyrexia, 216 have appointed consultants and 107 have made special arrangements for maternity nursing, while in many cases opportunity for bacteriological examination is provided under arrangements made by the Public Health Department.

The following figures are of interest in this connection. Notification of Puerperal Pyrexia came into force on October 1st, 1926. For the two years before this date notifications of Puerperal Fever were:—

1924	2,183
1925	2,396
Total	4,579

For the two years subsequent to 1926 the notifications were:—

		Puerperal Fever.	Puerperal Pyrexia.
1927		1,989	5,507
1928		2,380	5,499
Total		4,369	11,006

Total of Puerperal Fever and Puerperal Pyrexia ... 15,375

73. Another important way in which local administration has been brought into touch with problems of Puerperal Sepsis is the regulation of the practice of midwives under the Midwives Acts of 1902 and 1918. The valuable work done by Local Supervising Authorities under these Acts in inspecting the methods of practice of midwives and in carrying out measures to prevent the spread of infection through their agency is generally recognised. Co-operation of the midwife in these measures is encouraged by the right given her under the Midwives and Maternity Homes Act, 1926, to recover compensation from the Local Supervising Authority for loss of practice when she is "suspended in order to prevent the spread of infection."

Causes of Puerperal Infection.

74. It is now established that the most common infecting agent in severe Puerperal Sepsis is a haemolytic streptococcus, but evidence is accumulating which goes to show that the group of anaerobic streptococci also play an important part. Much investigation has been undertaken during the last few years into the source of the infection, the general manner of spread and the significance of certain predisposing causes.

Evidence as to the need for further research and the importance of co-ordinating laboratory work with clinical investigations was put before the Committee by experienced witnesses. Among the bacteriological problems specifically mentioned as calling for

elucidation were those concerned with immunisation, with air-borne infection, with the part played by "carriers," and with the bactericidal power of the blood.

75. On the suggestion of the Committee arrangements for affording advice and assistance in the bacteriological investigation of outbreaks of puerperal sepsis are under consideration by the Ministry of Health and the Medical Research Council. One of the difficulties in connection with epidemiological investigation is that bacteriologists have not formulated the precise criteria by which the inclusion of streptococci in the pyogenes (haemolyticus) group is to be determined. It therefore happens occasionally that streptococci isolated from the throats of puerperal fever "contacts" are labelled "haemolyticus" by one bacteriologist and something else by another. The help of the Streptococcus Committee of the Medical Research Council has been sought in this matter, and it is hoped that a statement may shortly be forthcoming which will make for greater uniformity and simplify the epidemiological problem.

Another practical difficulty is that of identifying any two strains of haemolytic streptococci with each other. An outbreak of sepsis is not necessarily explained by the isolation of haemolytic streptococci from the patients and from a midwife's throat. Whenever possible the strains should be shown to be identical. This problem is dealt with by Dr. F. Griffith and Dr. L. Colebrook in a Memorandum on "The Need for Bacteriological Services in the Control of Puerperal Infections." (See Appendix.)

Predisposing Causes.

76. Among the predisposing causes of sepsis the most important are undoubtedly injury to the tissues during labour, exhaustion and haemorrhage.

The reports submitted to the Fifth British Congress of Obstetrics and Gynaecology in 1925 on Puerperal Sepsis showed association with injury or repeated internal examination in 75 per cent. of cases.* Information obtained from the Committee's inquiry into maternal deaths shows that out of 616 cases of deaths from Puerperal Sepsis 241 (39·1 per cent.) were cases of instrumental, operative or breech delivery. An inquiry into two thousand cases attended in St. Bartholomew's Hospital district showed septic infection in cases of instrumental delivery to be tenfold those of normal delivery.†

The influence of exhaustion, following unduly prolonged labour, is a predisposing cause of sepsis which requires to be emphasised. In this connexion reference may be made to an interesting observation by Dr. R. M. Fry (not yet published) on the influence of extreme fatigue on the bactericidal efficiency of human blood. A

* Report. Journal of Obstetrics and Gynaecology of the British Empire, Vol. 32, 1925.

† Essay on Air-borne Infection in Puerperal Sepsis. Richard R. Armstrong, M.D., F.R.C.P., St. Bart.'s Hosp. Reports, Vol. LXII., 1929.

normal individual, whose power to kill staphylococcus had been carefully determined for several weeks, undertook a task which reduced her for some hours to a state of physical exhaustion. A sample of blood taken during that period showed a very sharp fall in bactericidal power. Recovery to the normal level occurred as soon as the exhaustion had passed off.

The well recognised effect of haemorrhage on the incidence of sepsis is also probably attributable directly to reduction of bactericidal efficiency of the patient's blood—particularly by the withdrawal of leucocytes. The great danger of manual removal of the placenta, on the other hand, is probably due to direct transfer of bacteria—particularly the anaerobic streptococci—from the vagina to the newly severed tissues and open blood vessels of the placental site.

As these predisposing causes can be very greatly diminished by ante-natal care and good midwifery the Committee have a reasonable hope of a lessened mortality from sepsis in the future.

77. The effect of environment on the production of puerperal infection has been much debated for many years. There is evidence from the records of many maternity district practices in poor neighbourhoods that so long as no definite source of infection is present, unhygienic and crowded dwellings and dirty surroundings do not in themselves increase the incidence of puerperal sepsis. On the other hand, the doctor and midwife are greatly handicapped by such conditions, which may lead to faulty management of labour, particularly in abnormal cases, while due nursing care of the patient may be impossible and her return to health greatly hindered by the lack of rest and quiet and of hygienic surroundings. In making this statement as to puerperal sepsis the Committee have not lost sight of the importance of social conditions as a less direct factor in maternal mortality, a subject which is referred to in another part of the report.

Sources of Infection.

78. It has long been realised that the source of infection may be extrinsic or intrinsic. In the former case it may be brought to the patient from another septic case by an attendant by means of fingers or appliances, or it may be due to infection from septic conditions in persons in contact with the patient, while in intrinsic infection may be due to the presence of septic organisms in the vaginal canal before labour, to infection from adjoining areas of the body such as the rectum, vulva or urinary passages, or to true autogenous infection—a condition now usually defined as one in which there is a focus of infection elsewhere in the patient's system, e.g., teeth, tonsils, gums.

That none of these many sources can be excluded from being, on some occasions, the starting point of puerperal sepsis is generally accepted, though there is considerable difference of opinion as to their relative importance or incidence. The well-known records of

certain institutions and district practices, showing over a long period a mortality markedly lower than the average, suggests that infection from a pre-existing focus in the patient (genital or extra-genital), cannot be a predominating cause in maternal infection as a whole. On the other hand, the majority of deaths from puerperal sepsis do not occur in epidemics, as might be expected if faulty external methods were the principal cause, but as single or "sporadic" cases. This appears to be borne out by the 616 deaths investigated by the Committee, where in only a few was there a note of association with another maternal death or case of puerperal sepsis. Too great weight, however, cannot be attached to this consideration, as further data might well have revealed a connection with other non-fatal septic cases.

79. In order to obtain more precise information as to the origin and development of the infections which engender puerperal fever, the Ministry of Health and the Medical Research Council have initiated investigations—or have assisted investigations already in progress—dealing with:

(1) The differentiation and classification of the haemolytic streptococci derived from puerperal infections, the throats of "carriers," cases of scarlet fever, etc. (Dr. F. Griffith, at the Ministry of Health Laboratory; Sir F. Andrewes, at St. Bartholomew's Hospital.)

(2) The occurrence of these streptococci in the genital tract before labour, and the correlation of their presence there with the subsequent development (or non-development) of "morbidity." (Dr. Hedley Wright and Mrs. Taylor, at University College Hospital.)

(3) The incidence of haemolytic streptococcal infections in severe and in mild puerperal fever respectively. (Dr. L. Colebrook and Dr. Hare, at Queen Charlotte's Hospital; Dr. Richard Armstrong, at St. Bartholomew's Hospital.)

(4) The relation between the immunity of parturient women to streptococcal toxins (determined by skin test) and their susceptibility to infection by haemolytic streptococci. (Mr. Burt White, Dr. L. Colebrook, Miss G. Morgan, Miss B. Jervis and Miss G. Harre, at the City of London Lying-In Hospital and Queen Charlotte's Hospital.)

(5) The fluctuations of virulence under varying circumstances of the haemolytic streptococci derived from puerperal infections; and the fluctuations in the capacity of these streptococci to withstand the destructive agencies of human blood. (Dr. Ronald Hare and Dr. E. W. Todd, at St. Mary's Hospital.)

(6) The part played by the anaerobic streptococci in puerperal infections. (Dr. L. Colebrook.)

Reports upon some of these inquiries have already appeared;* others will be published in the near future.

* Griffith, F., *Jour. Hyg.*, 1926, 25, 385; *idem*, 1928, 28, 250. Colebrook, L., *Brit. Med. Jour.*, 1930, I., 241. Armstrong, R. R., *St. Bartholomew's Hospital Reports*, Vol. 62, p. 169. Armstrong R. R., and Burt White, H., *Brit. Med. Jour.*, 1929, I., 592. Burt White, H., Colebrook, L., *et alia* *Brit. Med. Jour.*, 1930, I., 240. Hare, R., *Brit. Jour. Exp. Path.*, 1928, 11, 337; *idem*, 1929, 10, 375. Todd, E. W., *Brit. Jour. Exp. Path.*, 1927, 8, 1; *idem*, 1927, 8, 289. (See also "A Note on the Bacteriology of Puerperal Pyrexia," by Arthur Eastwood, in "The Protection of Motherhood," issued by the Ministry of Health, Report No. 48, on Public Health and Medical Subjects. Stationery Office, 1927.)

80. The Committee think it desirable to postpone the full discussion of this aspect of the problem until further data are made available by these or other investigations. It has become clear that puerperal fever has sometimes in the past been regarded too narrowly as being due to infection by only one microbial species—viz., streptococcus pyogenes (haemolyticus). Although the cases infected by that microbe are the most impressive, because they are the most fatal, they do not constitute the largest class of puerperal infections. It is probable that in the near future the group of anaerobic streptococci, which hitherto have been largely overlooked owing to technical difficulties in their cultivation, will be considered almost as important as that of the haemolytic type. In considering the sources of puerperal infection, it is essential to discriminate between the different microbial agents concerned: and also to avoid the making of hard and fast rules. Infection by organisms so widely distributed as the streptococci need not always be autogenous nor always exogenous—it may well occur sometimes in one way and sometimes in the other.

Some recent observations with regard to the incidence of infections by haemolytic streptococci may be briefly mentioned. Dr. Hedley Wright and Mrs. Taylor* have found that about $2\frac{1}{2}$ per cent. of women examined in London (1,120 examined) harboured haemolytic streptococci in the genital tract at the onset of labour, but that none of the women so infected developed fever and sepsis during the puerperium. The explanation of this latter fact is not quite clear, but it seems probable that the streptococci carried by the women were in a phase of low virulence, and therefore unable to initiate an infection. Whether that is always the case is not known, but it appears not unlikely in view of the well-known records of certain institutions conducting large midwifery practices in various parts of the country which are able to show a mortality rate much below the average for the whole country (e.g., only 1.5 deaths from sepsis per 10,000 labours) over a period of years.† Such successful results could hardly be obtained if autogenous infection by haemolytic streptococci was of common occurrence.

81. The alternative (exogenous) hypothesis, which attributes puerperal infection by haemolytic streptococci to transfer of these microbes to the woman in childbirth from the air, or the hands of attendants, or on the instruments, towels, dressings, etc., has found an increasing amount of support in recent years. Obviously the infection may occur—and has in the past often occurred—by direct transfer from an infected to an uninfected midwifery case, but that is probably not very common to-day. Evidence is accumulating which points to the danger of streptococci being conveyed to the mother from the throat or nose of one of those attending her. It is established that haemolytic streptococci, indistinguishable from the puerperal fever strains, frequently give rise to mild infections of the respiratory tract, especially tonsillitis, as well as the more severe infections, such as scarlet fever, quinsy, etc. Such streptococci are also sometimes found in the fauces of apparently normal individuals (healthy carriers). The number of these individuals

* Verbal communication to the Pathological Section, Royal Society of Medicine; to be published in the near future in the British Journal of Obstetrics.

† J. Young, M.D., F.R.C.S., B.M.J., June 9th, 1928.

cannot be stated as a given percentage of the population—it appears to vary within somewhat wide limits for different times and localities. Random samples of the population of large cities usually show not more than 2 to 15 per cent. of carriers; samples of nursing staffs taken at times of epidemic puerperal infection, on the other hand, have sometimes shown as many as 80 per cent. of carriers. Davis, in America, has stated that when 45 normal individuals were examined three times within one month haemolytic streptococci were cultivated from the tonsils of all of them on at least one occasion.* Investigations of a similar kind will no doubt be reported in this country in the near future. Whatever their result may show, it is already clear that haemolytic streptococci, potentially dangerous, must sometimes be sprayed into the air around the woman in childbirth either from her own throat, if she happens to be a carrier of these organisms, or from the throats of those attending her.

82. It does not follow that such air-borne streptococci, if they reach the maternal passages, will necessarily set up a puerperal infection. As suggested above that may well be determined by the phase of "virulence" in which they happen to be. Pending further evidence on the matter it may be considered probable, however, that streptococci which have recently set up an inflammation of the throat (tonsillitis, etc.) will be more highly infective, than those from a perfectly healthy carrier. Direct proof of this is very difficult to obtain, but its probability is well enough founded to justify the taking of special precautions to exclude such carriers with mildly inflamed throats from contact with parturient women.

83. When the question is asked whether puerperal infections have in fact ever been traced to such a "carrier" source it is very difficult to answer with complete assurance. However convincing the circumstantial evidence of infection from a throat carrier may appear there always lurks the possibility that the patient was one of the few women (about 2.5 per cent.) who harbour haemolytic streptococci in the genital tract before labour, and that these latter were really responsible for the infection. In these circumstances we cannot expect to get absolute proof. Perhaps the most conclusive instance yet published is that reported by Miss Nixon and Hedley Wright (*Lancet*, 1929, 1, 1242)—and the more so because in that case the infecting organism was a pneumococcus which is very rarely present in the genital tract.†

84. It is to be hoped that combined epidemiological and bacteriological investigation of future outbreaks on the lines suggested by Dr. Griffith and Dr. Colebrook in their paper published in the

* *Jour. Inf. Dis.* 1921, 29, 524.

† Other evidence—not quite so well substantiated—is given by the outbreaks of puerperal sepsis reported by Armstrong (*St. Bartholomew's Hospital Reports*, 1929, Vol. 52, page 169); King (*Brit. Med. Jour.*, 1930, 1, 533); Watson, *B.P. Amer. Jour. Obstet. & Gyn.*, 1928, 16, 157; Meleney and others; *ibid.* 1928, 16, 180.

Appendix to this report, will throw further light on the carrier problem in relation to puerperal sepsis. In the meantime the Committee take the view that the carrier must be regarded as a potential source of danger which the woman in childbirth should be protected against, so far as possible, by a wider use of masks and a more effective antiseptic ritual for the hands of those conducting midwifery work.

The Committee is giving further consideration to the efficiency of masks. It is clear that many of the loose-meshed patterns in use at present are of little, if any, value as filters of salivary spray. Pending further evidence on the matter the type of mask described by Walker (Surgery, Gyn, and Ost. 1930, 50, 266), which incorporates a small square of impervious material such as rubber, in a larger mask of close-meshed gauze, may be recommended as the most likely to be effective.

85. Evidence as to the importance, as a source of extrinsic infection, of marital intercourse late in pregnancy was brought to the notice of the Committee by representatives of the British College of Obstetricians and Gynaecologists and of the Medical Women's Federation, with a recommendation that the patient should be definitely advised on this point at the ante-natal examination. With this view the Committee concur.

Infection in Maternity Homes and Hospitals.

86. The question of the part played by contagion becomes of the greatest practical importance when the incidence of infection in maternity homes and hospitals is considered. Here, undoubtedly, definite epidemics occur from time to time. They are usually checked by prompt action, and nowadays rarely attain serious proportions, but the occurrence of two or three deaths in an outbreak of this kind is so tragic, and the anxiety to all concerned so great, that success in tracing the cause and securing the safety of the patients must be sought by all means at our disposal.

87. So far as abnormal cases are concerned, the greatly enhanced prospects of safe delivery in a well conducted institution are generally recognised. Success in the treatment of cases of eclampsia or severe haemorrhage is enormously increased by the facilities afforded by a hospital, while operative or difficult instrumental delivery calls for all the help which is given by a well-equipped operating theatre, adequate arrangements for sterilising, good light, skilled assistance and experienced nursing.

88. But in many of the fatal cases of puerperal sepsis (47·7 per cent. in the Committee's series) death follows normal labour. A small proportion of these occur in connection with outbreaks of sepsis in homes or hospitals, and not infrequently in institutions where all generally accepted precautions are in routine use, and where the record has for long periods been satisfactory. It is with special reference to normal cases that the relative safety of hospital and domiciliary treatment has been recently discussed.

Dr. Parlange Kinloch's Paper on Maternal Mortality in Aberdeen for the years 1918-27 shows that in this series of cases the mortality rate from sepsis was, in the domiciliary practice of midwives, 1 per

1,000 confinements, and of doctors 1·7, while in institutions it amounted to 4·5 per 1,000.* A higher mortality rate is, however, expected in institutions on account of the large number of abnormal cases admitted.

The figures for 111 institutions making returns to the Ministry of Health have been summarised for the five years 1924-28.

					No. of Beds.	No. of Institutions.
Group 1	...	...	...	...	1-10	51
Group 2	...	...	...	...	11-20	42
Group 3	...	...	...	...	21-50	18

Large maternity hospitals* are excluded, but about 50 per cent. of the institutions included receive a number of cases on account of abnormality. During the five years referred to, 94,711 maternity cases were received in these institutions. The total deaths from sepsis were 101, or a ratio per 1,000 births of 1·06 as against the average for the whole country over that period of 1·58.†

Investigation of Outbreaks.

89. From the study of outbreaks of puerperal sepsis in institutions the conclusion appears inevitable that a routine of practice which is adequate to guard against infection under ordinary circumstances is apt to break down when once a virulent infection has been introduced. This may be due to slight acts of carelessness in nursing or relaxation of strict observance of precautions in the conduct of labour, or it may be due to the entrance of a new factor such as airborne infection. Outbreaks of this kind have been the subject of careful investigations by hospital authorities, by Medical Officers of Health and by Medical Officers of the Ministry of Health. Experience shows that while failure of antiseptic methods sufficient to account for the spread of the disease is sometimes clearly established, in other inquiries no such factor is discovered. The primary source of the infection, on the other hand, had sometimes been traced, e.g., in recent outbreaks, a septic finger in a nurse; atrophic rhinitis in a pupil; antral empyema in a midwife; cellulitis of the cheek in a post-graduate student; a severe furunculosis in a patient's husband.

90. Two dangers, however, stand out as of primary importance in institutional practice, an importance not yet fully appreciated, although confirmed by repeated experience. The first is the retention in lying-in wards of mild cases of pyrexia, often of unknown origin. The necessity for complete isolation of cases definitely diagnosed as puerperal sepsis and their contacts is, of course, generally accepted, but the occurrence of a series of apparently trivial cases of pyrexia among a number of normal cases has not infrequently

* Maternal Mortality. J. Parlange Kinloch, M.D., J. Smith, M.D., D.Sc., and J. A. Stephen, M.A., M.B. Published by the Scottish Board of Health, 1928.

† This figure is approximate. In 39 of the 101 cases death occurred after removal of the patient to another Institution, and it is possible that a few deaths in this group have not been reported to the Ministry of Health.

been a precursor of a severe outbreak of sepsis, and prompt and effectual separation of such patients may avert a disaster.

The second point to which the Committee desire to draw attention is, the risk of admitting emergency cases of labour, potentially infected by previous attempts at delivery, or cases of threatened, incomplete or septic abortion, into lying-in wards containing normal patients. From cases of this type infection has been known to invade the whole institution, and to be eradicated only by its temporary closure and complete disinfection. Evidence on this point has been put before the Committee by the British College of Obstetricians and Gynaecologists, by the Medical Women's Federation, by Professor Munro Kerr, Dr. James Young and Dr. Farquhar Murray. They consider that provision should be made in every maternity hospital for the separation of suspected and pyrexial cases. Most of these witnesses expressed the opinion that this should take the form of three complete and separate units with separate staff, including labour and receiving rooms as well as lying-in wards. One, the largest, should be reserved for "clean" cases, *i.e.*, for patients previously booked for admission and supervised during pregnancy, while two smaller blocks should be allocated to emergency and septic cases respectively. Dr. Farquhar Murray gave some interesting figures as to the diminishing incidence of pyrexia since classification of patients somewhat on these lines was carried out in the Princess Mary Maternity Hospital, Newcastle-on-Tyne.

Methods of Sterilisation.

91. Reference has been made above to "accepted precautions" in the conduct of labour and lying-in. This subject is in some respects highly technical, but certain points call for consideration here.

The adoption of effectual methods of sterilisation is a matter of primary importance in obstetrics as in surgery. Fortunately, the sterilisation of instruments, appliances, dressings, towels, bedding, etc., by exposure to high temperatures by appropriate measures offers no serious difficulty, but it is otherwise with the skin of the patient and the hands of the attendant. For these, various routine methods have been devised, beginning with mechanical cleansing, followed by the use of chemical solutions. The preparation of the hands is supplemented in many instances by the use of sterilised rubber gloves. In the opinion of some experienced obstetricians modern methods aim too exclusively at "asepsis" (an attempt, subsequent to initial sterilisation, to maintain this condition without further use of antiseptics), and they believe that a freer use for the skin of the patient and attendant alike of antiseptics of known strength and proved value is essential for satisfactory work. Another point to which the Committee's attention was drawn by several witnesses, and which is confirmed by their own experience, is the failure of many midwives and nurses to prepare with accuracy antiseptic solutions of measured and effective strength, particularly in the case of Lysol.

92. A special report on the sterilisation of the hands has been drawn up by Dr. Leonard Colebrook, a member of the Committee, and is printed in the Appendix to this Report. The matter is, however, of such commanding importance that it is expedient to quote here the conclusions at which he arrives.

"Sterilisation of the hands aims at preventing the transfer of pathogenic bacteria to the genital passages of the mother (a) by an initial thorough antiseptic toilet and (b) by further treatment from time to time during the course of labour in case the hands have become contaminated by contact with infective material. It is not perhaps generally recognised that this contact with infective material may be only a sub-perceptible contact. The hands may be re-infected with streptococci by salivary spray ejected by coughing, sneezing, and even in the course of conversation.

Haemolytic streptococci, indistinguishable from those which cause puerperal infections, are known to be present from time to time in the fauces of a certain number of people. It sometimes happens that the parturient woman herself, or one of her attendants, is one of these people. In that event, streptococci, potentially dangerous, are being unconsciously sprayed into the air around the patient during the period of labour. Some of them will reach the hands of the attendant, and so, indirectly, may be transferred to the vulva or vagina.

The experiments here reported show that the initial antiseptic toilet as commonly advocated in this country, viz., thorough washing, followed by treatment of the hands for 3 minutes with perchloride of mercury (0.1%) or lysol (0.62%) of good quality will usually succeed, if it is conscientiously carried out, in getting rid of any haemolytic streptococci with which the hands have become contaminated. Washing alone removes the greater number of such streptococci. It must be emphasised, however, that these procedures do not sterilise the hands in the bacteriological sense. Staphylococci and sometimes diphtheroid bacilli can still be cultivated from them. Moreover, as a means to the elimination of streptococci, this antiseptic toilet offers only a small margin of safety. If the washing is perfunctory, or the strength of the antiseptic solutions is reduced, or, again, if the streptococcal contamination of the hands is a heavy one and combined with serous discharges, killing is likely to be incomplete.

There would seem to be little to choose between perchloride of mercury and a lysol of good quality, such as the one employed in my experiments for the initial antiseptic toilet of the hands. In view, however, of the fact that lysol is somewhat more prone to irritate the skin (and in consequence is often used in very dilute solution), and the further fact that the several brands of lysol now on the market have different characters and bactericidal potency, there is much to be said for discontinuing the use of these products in midwifery until such time as their manufacture is so regulated as to ensure uniformity of bactericidal power combined with low toxicity for skin tissues.

Iodine (0.5-1%) or chloramine T. (1%) are more efficient for killing haemolytic streptococci on the hands than either perchloride or lysol, and should be tried. Their use is open to some objections (smell, staining, etc.), and it is not unlikely that they would be found too irritant for frequent use.

The problem of re-sterilisation of the hands at intervals is more difficult. The midwife needs for this an antiseptic solution which can be relied upon to kill streptococci on the hands quickly, i.e., within 2 or 3 minutes at most—and *without previous washing*. Only iodine and chloramine T. have been found to fulfil this condition. Perchloride (even 0.2%) and lysol (0.62%) do not.

The situation may be summed up as follows: For the ordinary run of clean midwifery practice the measures usually employed to prevent the transfer of pathogenic streptococci on the hands to the parturient woman

will usually suffice. They do not, however, offer a sufficient safeguard when circumstances favour the epidemic spread of puerperal infection, i.e., when those attending the labour, or the patient herself, are carriers of pathogenic strains.

Since the occurrence of these circumstances cannot be foreseen, it is desirable, in the interests of safer childbirth, *that rubber gloves should be much more widely employed in all midwifery work.* Smooth, thin gloves can now be bought very cheaply, and, if not heated, wear well. Their sterilisation on the hands is very readily effected, with or without washing, e.g. by perchloride of mercury (0.5%) or biniodide in spirit (0.4%) or carbolic acid (1%).

93. The Committee fully concur in Dr. Colebrook's warning that under the circumstances at present obtaining in regard to the different degrees of potency of various brands of lysol, as sold or as used, it is important that its widespread adoption should be discontinued unless and until the user is fully assured and satisfied, beyond all doubt, that the actual lysol he (or she) is using is of uniform and effective bactericidal power and low toxicity for skin tissue. The Committee also join with Dr. Colebrook in recommending the use of sterilised rubber gloves, which can be re-sterilised on the hands as often as occasion requires by washing in a strong anti-septic solution.

94. In connection with the technique of disinfection certain other points (detailed, but not therefore unimportant), have been considered by the Committee. There is general agreement as to the need for the provision of sterilised pads and swabs, for the routine disinfection of bed-pans by boiling, and for the use by attendants of sterilised gowns and head coverings. The use of masks (discussed from the bacteriological point of view on p. 53) appears a wise precaution in hospital work, and there is some evidence that they should be worn by the nurse attending to the patient in the lying-in ward as well as in the labour room.* A definite opinion in favour of the wearing of masks as a routine was given by the representatives of the Royal College of Physicians and the British College of Obstetricians and Gynaecologists. The question of the further practical application of this principle continues to engage the attention of the Committee.

Hospital Construction.

95. The construction and equipment of maternity institutions is a matter of considerable importance in securing good results. The general principles of hospital construction are, of course, applicable, but certain special points may be noted in addition to the need for separate septic and emergency blocks referred to above. The wards should allow a floor space of not less than 96 square feet per bed (including mother and baby). It is important that the wards should be emptied and "spring-cleaned" at short intervals, and for this reason and also to diminish risk of infection small wards not exceeding six or eight beds are better than large wards. Floors

* Throat Infections as an Etiological Factor in Puerperal Fever. W. W. King, M.B., F.R.C.S. Brit. Med. J., 22-3-30.

and walls should be washable, angles rounded and ledges avoided. Labour rooms, sluice rooms and sterilising rooms should be constructed and equipped on surgical principles. Even in small Homes a room which can suitably be used as an extra labour room in case of need should be provided. One or two single wards, placed as far as possible from the labour and lying-in ward, should be reserved for temporary separation. A babies' nursery and bathroom is required.

Staffing.

96. The staffing, both medical and nursing, of maternity institutions is obviously a matter of primary importance. In Maternity Hospitals large enough to require a resident Medical Officer, and favourably situated to receive the services of a specialist staff, no serious questions other than those of individual efficiency arise, but a decision as to the best method of medical supervision in small Hospitals and Homes is one of much practical difficulty. From the point of view of efficient administration, particularly with regard to the problems of puerperal sepsis, the guidance of a single Medical Officer is essential. The problem is to combine effectually such control with the system, desired in many areas, of attendance on their own patients by a number of doctors, as in this case there are apt to be such variations in standards and methods of work as to render satisfactory management of the institution most difficult to the Matron and nursing staff. This matter has been referred to by the Committee in the section on a National Maternity Service.

97. The nursing staff required varies with the circumstances of the case, and particularly with the presence or absence of an attached training school for midwives. The tendency is undoubtedly to under-estimate the staff needed for efficient work. The presence of pupils, especially if untrained, adds appreciably to the risks of infection unless adequate supervision is maintained, not only in labour, but in the day by day routine of the lying-in wards. Even where the pupil has had previous hospital training the precautions required in the nursing of the puerperal patient and the newborn infant are new and have to be learned and appreciated.

The Matron and sisters and, where possible, the staff midwives of maternity institutions should have had a general nursing training and not only training and experience confined to midwifery. Indeed, the Matron of such an institution bears a heavy load of responsibility, and requires exceptional personal qualities. In addition to professional knowledge and a clear grasp alike of the principles of antiseptics and of the minutest details of their application, she must have the high conscientiousness to carry them out at whatever inconvenience, and the personality and intelligence to impress them upon her staff.

98. The need for a careful physical examination (which should include bacteriological examination of swabs from throat and nose) of all pupils or of newly appointed members of the nursing staff, before they take up duty in the maternity ward, is not always

appreciated. Moreover, the Medical Officer or Matron should explain to them personally the importance of reporting immediately any variation from normal health, however trivial it may appear, and the disastrous consequences which may follow from a well-meant but ignorant concealment of such conditions. It should become an invariable rule for the Matron to report at once to the Medical Officer all cases of abrasion or spots on the skin, catarrh, laryngitis or sore throat. Throat and nose conditions in particular should be bacteriologically investigated, and, if haemolytic streptococci are found, the individual in question should, if practicable, cease to have any contact with women in labour or recently delivered until further bacteriological examination fails to demonstrate the presence of these organisms.

Treatment.

Accommodation.

99. The Committee wish to call particular attention to the need for increased provision of beds for cases of puerperal sepsis throughout the country—and for their concentration, whenever feasible, in a smaller number of Hospitals than heretofore. The policy of concentration would, it is believed, have a considerable effect in reducing the mortality rate of these infections. It would lead in most cases to a higher standard of treatment being applied to them, and, what is perhaps still more important in the saving of life, it would facilitate the progress of research.

100. Partial provision on these lines has been made in one or two large towns, e.g. in Manchester (at the Monsall Fever Hospital), in Sheffield (at the Jessop Hospital, Norton Extension), and in Birmingham (at the Women's Hospital, Sparkhill), though in most areas facilities for treatment in special institutions are entirely lacking. The problem as it applied to London received consideration by the Ministry of Health in 1925, when it was found that beds in practically all the General Hospitals, Poor Law Institutions and Metropolitan Asylums Board Hospitals for infectious diseases were available for cases of puerperal fever, but that each institution received so few that there was no opportunity for systematic investigation or for the Medical Officers (usually quite untrained in this kind of work) to become proficient in their management. Arrangements were therefore made with the Metropolitan Asylums Board for allocation of patients suffering from puerperal sepsis to one or more specified hospitals under their management and for the appointment of an obstetric specialist to direct the treatment of the cases. Local Authorities were invited to co-operate by arranging where practicable to send notified cases of the disease to these hospitals.

101. There are already some indications of a lowered mortality rate following the adoption of this policy of concentration. The cases received into the hospitals of the Metropolitan Asylums Board for 5 years prior to 1925 showed an average mortality rate of 20 per cent. (variations between 16·6 and 23·7); from November, 1925, to

February, 1928, in a series of 415 cases it was 12·5 per cent. and during 1928 in a series of 208 cases it was 13·4 per cent. In giving evidence before the Committee Mr. Montagu Wyatt (in charge of Metropolitan Asylums Board cases) expressed his opinion of the value of the concentration of patients in one Institution, for purposes of treatment and research. He also pointed out the importance of early admission of cases so that prompt bacteriological investigations could be made.

102. The Committee wish to emphasise the desirability of making more use of some of these puerperal fever centres for the purposes of research. Although provision has been made for the routine bacteriological examination of the cases treated in them, comparatively little progressive research work has been undertaken, chiefly on account of the lack of adequately equipped laboratories in close association with the puerperal fever wards, and of research workers free from other claims. Special interest in this connection attaches to the opening in July next of an isolation block of 30 beds at Hammersmith by Queen Charlotte's Hospital, to which will be added in a few months a laboratory block for the accommodation of several bacteriological and bio-chemical research workers. Later, a large new maternity hospital is to be built on the same site. Over and above the laboratory workers required for the routine investigation of cases in the septic block, the maternity hospital and its ante-natal department, the whole-time services of two, or perhaps three, research workers will be provided by the Medical Research Council, and it is hoped that an effective attack will be made upon some of the pressing problems of puerperal fever. Such an organisation, comprising puerperal fever wards, an active research laboratory, and a large maternity hospital might well serve also as a centre of post-graduate teaching about the prevention and treatment of puerperal infections, the toxæmias of pregnancy, the modern technique of blood transfusion, etc., which is at present very inadequately provided for. Short courses of such teaching made available for the medical officers of puerperal fever wards and maternity hospitals could hardly fail to result in a raising of standards throughout the country. And the exchange of ideas among those attending such courses would probably also stimulate research.

Methods of Treatment.

103. In cases of puerperal sepsis of mild type, or not associated with demonstrable blood-infection, general measures for increasing the resistance of the patient and securing free drainage give good results in a large proportion of cases. Exploration of the uterus is usually avoided unless there is clear evidence of retained products of conception. Peritonitis and pelvic or metastatic abscesses call for treatment on general surgical principles.

An enquiry into the scope and value of the method of treatment of puerperal sepsis by intra-uterine injections of glycerine, as

advocated by Dr. Remington Hobbs, has been instituted by the Committee. A number of hospitals were approached through their obstetric staff and invited to make certain observations and to furnish special records on this point; twenty-one hospitals agreed to cooperate and the results will be summarised when a year's work has been completed.

Another matter calling for investigation is the value, in the prevention of septic infection, of the administration of vitamin A during pregnancy, as advocated by Prof. E. Mellanby.*

The treatment of acute puerperal septicaemia, however, still taxes all the resources of medicine, and in some series of cases (where the organisms have been demonstrated in the blood) the mortality has reached 100 per cent. Methods adopted include the use of polyvalent anti-streptococcic serum, autogenous vaccines, injections of arsenical or quinine compounds, saline infusions and immuno-transfusion. These measures, together with suitable nourishment, the judicious use of stimulants, careful nursing, sunlight and fresh air, give occasional good results, but the general problem awaits solution.

* "Vitamin A as an Anti-infective Agent." E. Mellanby, M.D., F.R.C.P., F.R.S., and H. N. Green, M.D., Ch.B., M.Sc. Brit. Med. Journal, 1-6-29.

CHAPTER V.

ANTE-NATAL CARE.

104. The importance attached by the Committee to systematic and skilled ante-natal care as a means towards the reduction of maternal mortality can hardly be overstated, and their opinion is supported by evidence given by witnesses of wide obstetric experience representing the great medical bodies who have appeared before them.

105. The pioneer of ante-natal work in this country was Dr. J. W. Ballantyne, of Edinburgh, who was the first serious student of the physiology and pathology of the pregnant state, and the first obstetrician to teach that the right conduct of labour could not be separated from the observation and treatment of conditions obtaining during pregnancy. His work on "Ante-natal Pathology and Hygiene," published in 1902, first brought the study of obstetrics into the field of preventive medicine. The ante-natal clinic and the pre-maternity beds which he established in connection with the Edinburgh Royal Maternity Hospital, were the forerunners of the considerable provision on these lines found in England to-day. When the first National Conference on Infant Mortality was held in 1906, Dr. Ballantyne gave an address on ante-natal causes of infant mortality, which set forth the close connection of problems of infant mortality and ante-natal hygiene.

106. In 1914 the first circular taking cognisance of ante-natal care as a factor in public health was issued by the Local Government Board. This circular offered grants to Local Authorities providing *inter alia* clinics for medical observation of expectant mothers and their instruction in the hygiene of pregnancy, home visiting and provision of beds for the treatment of ante-natal complications. These measures were further extended by the Maternity and Child Welfare Act of 1918, and since the establishment of the Ministry of Health in 1919 the needs of the expectant mother have taken an increasing place in national and local schemes for maternity and child welfare. Teachers of obstetrics followed in Ballantyne's steps, and the large maternity hospitals have gradually opened clinics for this purpose, though anything approaching routine observation of all cases "booking" for attendance was long delayed and is yet far from complete.

Importance of Ante-natal Care.

107. Brief consideration only is required, in the light of modern knowledge and experience, to show over how wide a field the risks of childbirth may be lessened by careful observation and treatment during pregnancy. Perhaps the most brilliant results are found in the almost complete elimination of eclampsia, revealed in the records of certain hospitals where systematic ante-natal observations are made and early recognition and treatment of toxæmia thus secured. Early diagnosis of mechanical difficulty due to such causes as contracted pelvis, disproportion in size between the pelvis and the foetal head, malpresentation, and pelvic tumours is of incalculable

value in determining and carrying out the best line of treatment, and it is to be hoped that the deaths from obstructed labour due to such causes, too many of which still appear in the death returns, will steadily diminish as a result of increased anti-natal care. The part played by focal sepsis, e.g., in connection with teeth or tonsils, and the importance of infections of the urinary tract are beginning to be better understood. Greater attention is being paid to the effect of pregnancy on various forms of chronic disease, particularly of the heart and kidneys, as well as to the early diagnosis and treatment of venereal disease complicating pregnancy.

108. The figures given below show what can be done in a definite series of cases by systematic ante-natal care, combined with careful midwifery, towards the elimination of eclampsia, though the variation in the incidence of the disease in different parts of the country must not be overlooked:—

<i>Hospital.</i>	<i>Years.</i>	<i>Cases.</i>	<i>Deaths from Eclampsia.</i>
Louise Margaret Hospital, Aldershot *	1926-27	2,000	None
East End Maternity Hospital †	... —	Last 10,000 consecutive cases	None

A study of the Registrar-General's returns from 1911-28 for unselected cases shows no diminution and very little variation in deaths from "puerperal albuminuria and convulsions" per 1,000 births during the last 20 years.

1911	...	...	...	...	...	...	0.7
1916	...	...	...	...	...	...	0.83
1921	...	...	...	...	...	...	0.71
1926	...	...	...	...	...	...	0.75
1928	...	...	...	...	...	...	0.84

The following tables from two hospitals give an interesting comparison of death rates:—

<i>Hospital.</i>	<i>Years.</i>	<i>Cases.</i>	<i>Maternal Deaths.</i>	<i>Death Rate per 1,000 Births.</i>
† East End Maternity Hospital (Hospital and District)	1884-1913 (Ante-natal supervision of some patients)	19,564	37	1.9
Ditto	1921-28 (Routine ante-natal supervision of all patients)	17,525	12	0.68
‡ Guy's Hospital (District practice) (no beds)	Oct., 1863, to Sept., 1875 (No ante-natal supervision)	23,591	106	4.4

* Major Moss, I.M.S. British Medical Journal, 29.12.23.

† Ante-natal, Natal and Post-natal Problems. By W. H. F. Oxley, M.R.C.S., L.R.C.P. British Medical Journal, 15.2.30.

‡ Contribution to the Study of the Maternal Death Rate. By G. F. Gibberd, M.S., F.R.C.S. Lancet, 14.9.29.

<i>Hospital.</i>	<i>Years.</i>	<i>Cases.</i>	<i>Maternal Deaths.</i>	<i>Death Rate per 1,000 Births.</i>
Guy's Hospital (Hospital and District Practice, excluding emergencies from outside sources)	1929-28 (Regular ante-natal supervision)	21,423	22	1·03

Mr. Gibberd has further analysed his figures, and has selected the four causes of death which are most likely to be affected by ante-natal supervision with the following result:—

		<i>Deaths per 1,000 Births.</i>	
		1863-1875 (23,591 births).	1919-28 (21,423 births).
Disproportion ... ..	...	0·76	0·19
Malpresentation ... ..	...	0·08	0·046
Toxaemias of pregnancy ... ..	...	0·29	0·14
Intercurrent diseases ... ..	...	0·32	0·24

109. Research into neo-natal mortality throws some light on the need for better ante-natal supervision, as well as for improved methods of delivery. Mr. Eardley Holland, in his valuable report*, shows that in a series of 300 stillborn foetuses submitted to careful post-mortem examination, the cause of foetal death in 51 per cent. was some complication of labour, and that injury to the child's head during delivery was a far more frequent cause of foetal death than was generally supposed. Syphilis accounted for 16 per cent. of cases, and toxaemia of pregnancy and chronic renal and other maternal diseases for a further 12 per cent. Of these cases (79 per cent. of the total) he estimated that 53 per cent. were preventable by improved ante and intra-natal care.

A more extended enquiry by Mr. Eardley Holland and Dr. Janet Lane-Clayton†, published in 1926 under the auspices of the Medical Research Council and founded on 1,673 cases of stillbirth and neo-natal death submitted by investigators in different parts of the country, showed similar general results, though the deaths in this series due to complications of labour showed a smaller percentage (27·2).

A recent report on neo-natal death by Dr. J. N. Cruickshank‡ tallies the same lesson. It is based on a study of 800 infants who died within 28 days of birth, and shows that 540 (67·5 per cent.) died from causes operating during delivery (birth asphyxia, atelectasis, birth injury or prematurity) the remaining 32·5 per cent. being due to infective conditions or developmental defects.

* Report on the Causation of Foetal Death. No. 7 of Reports on Public Health and Medical Subjects published by the Ministry of Health, 1922.

† Child Life Investigations: A Clinical and Pathological Study of 1,673 cases of Dead-Births and Neo-natal Deaths, compiled by Eardley L. Holland, M.D., F.R.C.P., F.R.C.S., and Janet E. Lane-Clayton, D.Sc., M.D. Special Report Series of the Medical Research Council, No. 109.

‡ The Causes of Neo-natal Death, by J. N. Cruickshank. A Report on a series of Child Life Investigations published by the Medical Research Council, 1930.

Limitations of Present Practice.

110. In spite, however, of the attention given to the subject during the last few years by obstetricians and by the public health service, the results of the maternal death inquiries and other evidence at the disposal of the Committee shows that the ideal laid down by Dr. Ballantyne that "all labour should be prepared for during pregnancy and conducted in accordance with the discoveries then made" is far from being attained. It is acknowledged that, speaking generally, the present standard of ante-natal care remains below the standard required for safeguarding the mother, even within the limits of our present knowledge. Many pregnant women receive little or no ante-natal supervision, and there is reason to believe that in some cases the supervision is so insufficient that harm may be done by giving a false sense of security. This is, perhaps, hardly surprising in view of the short period during which prominence has been given to such ideas. Although a few obstetric teachers have presented the subject to their students with enthusiasm for years, there are certain medical schools which have only within the last year or two made attendance at an ante-natal department obligatory on their students (in accordance with the recommendations of the General Medical Council in the revised Curriculum of 1923). The Central Midwives Board has from the first required midwives to receive instruction in the diagnosis and management of normal pregnancy, and the signs and symptoms of abnormal pregnancy, but not until 1927 did they include ante-natal care among the duties required from the practising midwife under the Rules of the Board.

Principles of Ante-Natal Care.

111. The principles of ante-natal care are now fairly well established. The object of physical examination is to insure that as far as possible any abnormal conditions present shall be detected and treated, and any probable difficulties in labour foreseen. This involves careful consideration of the patient's health, as well as of her obstetric history and condition. Pelvic measurements should be taken and abdominal examinations made to determine the position of the child and the relation of the head to the brim of the pelvis. Detection of early signs of toxæmia is of primary importance, and for this reason there should be frequent and regular testing of urine and observation of blood-pressure. Ante-natal care should also include measures directed against infection, e.g., adequate dental treatment, bacteriological examination of urine or of cervical discharges, treatment of any other septic foci and measures for the diagnosis and treatment of venereal disease.

112. Excellent results in both mother and child have been obtained in the treatment of women suffering from venereal disease, and any difficulty in persuading them to undergo effectual treatment is well worth the effort.* In order to obviate the natural reluctance of many of these patients to attend the ordinary venereal disease

* Annual Report of the Chief Medical Officer of the Ministry of Health, 1925.
(3623.)

clinics, special sessions have been arranged with success in connection with certain maternity hospitals and ante-natal clinics. Apart from the other important considerations involved, the part played by the gonococcus as a source of puerperal infection may be specially noted.

113. Some opinions on the importance of ante-natal care given in evidence may be quoted.

Royal College of Physicians: "In the care and supervision of the sub-normal mother, much more preventive work can be done by a closer co-operation with other clinics, e.g., with that of general medicine and also with dental and throat departments."

British College of Obstetricians and Gynaecologists: "Effective ante-natal investigation demands the highest skill, for while obvious lesions may readily be detected, a large number which present few or no symptoms and signs during pregnancy may lead to grave disasters then and in parturition and in the puerperium."

Professor Munro Kerr: "Many disturbances of pregnancy are most insidious in onset, and much more elaborate examination and supervision is necessary than is generally referred to by writers on the subject."

It is evident from these considerations that every patient should come under medical observation at some time during her pregnancy, although the midwife may, with advantage, be entrusted with the duty of making certain routine observations and reporting any deviation from the normal to a doctor.

Methods.

114. The Committee considered methods of ante-natal care at an early stage in their deliberations. They addressed inquiries to a number of hospitals and public health departments as to the practice adopted at their clinics, and received in reply a large amount of valuable information willingly placed at their disposal. They subsequently drew up a Memorandum on Ante-natal Clinics: Their Conduct and Scope, which was issued by the Ministry of Health to Local Authorities in July, 1929.* The recommendations in this Memorandum as to the minimum scope of ante-natal examinations which may be considered adequate may usefully be quoted here:

"A patient should attend first at the sixteenth week of pregnancy, unless owing to trouble at a previous confinement she has been asked to attend earlier. At this visit a full medical and obstetrical history should be taken, and, if she is prepared, a physical examination should be made. This should include examination of the urine, and an estimation of the blood pressure as a standard for future reference. Dental treatment, if found necessary on examination, should be arranged for. The pelvic measurements should be taken. The question of vaginal examination should be left to the discretion of the Medical Officer, but would always be desirable where there is a discharge or a history of difficult or septic labours, Wasserman reaction should be ascertained where necessary. The breasts should be examined in all cases.

After the examination by the Medical Officer is completed the nurse should enquire into home conditions, and advise her on hygienic matters. Where necessary the home should be visited. The date and hour of the next visit to the clinic should be arranged.

From this time routine examinations should take place either at the

* See Appendix.

clinic or the patient's home as follows:—At the 24th and 28th weeks, from then every fortnight until the 36th week, and thence weekly until she is confined. The uterine height and girth should be taken, the foetal heart listened for, and urine tested, and general enquiries should be made, with special regard to the action of the excretory organs. The midwife should be able to do this examination in most cases at the patient's home, but *any abnormality*, however slight, *must* be brought to the notice of the Medical Officer of the clinic.

In place of, or supplementing, the routine examinations, special examination should be made by the Medical Officer at the 32nd and 36th weeks. These will be directed mainly to ascertaining the presentation of the foetus, and the relation of head to pelvis.

It is advisable that where possible the Blood pressure should be examined weekly during the last month, as a rise of pressure may be the first sign of a commencing toxæmia.

It is important that the expected date of confinement should be ascertained early in pregnancy, and be confirmed from time to time, and any patient going beyond the 40th week should be referred to the Medical Officer.

If a patient should at any time develop abnormalities rendering her case unsuitable for attendance by a midwife alone, the latter should be informed."

General Management of Pregnancy.

115. Apart from actual disease and the prevention of abnormal conditions, there appears to be considerable need for improvement in the general management of pregnancy. A great deal can be done to ensure normal childbirth by careful instruction as to general and personal hygiene, and as to the need for suitable exercise in the open air, adequate sleep and well-devised clothing. Diet, too, plays an important part. As research yields further information as to the metabolism of pregnancy, it will become possible to advise with increasing confidence on this point. At present it appears generally established that there should not be too great a departure from the patient's customary food, but that a generous quantity of fresh fruit and vegetables, and a minimum of meat tend to keep her in good health. The encouragement of a confident and cheerful mental outlook is of more importance than is perhaps generally realised, and this psychological factor may be of special importance nowadays when, according to some of the evidence received, fear of childbirth is prevalent, and is, no doubt, to some extent aggravated by the public discussion of maternal mortality and of the efforts being made to diminish it.

116. It may be objected that so close a supervision of pregnancy is a counsel of perfection which can be secured where the patient's means allow of an adequate fee to the doctor for his expenditure of time and attention and where she on her side gives active co-operation, but that it is entirely impracticable in the ordinary middle or working-class practice. But it must be remembered that any marked restriction in the extent of ante-natal care described will undoubtedly diminish that degree of safety to the woman in childbirth which is possible in the present state of our knowledge, and whatever arrangements are proposed for the improvement of midwifery must take this matter into account. It is probable that as patients and their husbands become educated to the idea of what constitutes

efficient ante-natal care, some will be able and willing to pay adequately for it, while in cases where such payment is impossible increased public provision will be needed.

Organisation.

117. The best method of securing adequate ante-natal care for all expectant mothers is a matter which has received special consideration by the Committee, and particularly in connection with the development and expansion of a National Maternity Service. A reference to this section of the Report will show that in the Committee's opinion a satisfactory scheme must be based upon the principle that the person responsible for ante-natal supervision should be the person responsible for attendance during labour. The lines on which it is hoped to establish such a system are set out in detail in the same section.

118. Under existing conditions the obligation of Local Supervising Authorities under the Midwives' Acts to pay the fee of a doctor called to the assistance of a midwife extends to cases of abnormality found during pregnancy. The Committee have reason to believe that many midwives are not fully aware of this provision and that they should be encouraged to refer such cases more frequently to a doctor, preferably to the doctor who will be called to attend in any abnormality of labour.

119. At present the type of organisation which best meets the need for systematic ante-natal care is probably the hospital ante-natal clinic, with its specialist officers, pathological laboratory and facilities for special treatment, both in-patient and out-patient. But such clinics serve only a small minority of patients, and the ante-natal clinics provided by Local Authorities in connection with their maternity and child welfare schemes, although they are far from covering the whole field, form the only organised contribution to the general problem. These Local Authority clinics have admittedly done admirable work, both clinical and educational, and have served to call the attention alike of the medical profession and of the public to the importance of the matter, and the Committee recognise that, for the present, these clinics are indispensable for securing ante-natal care where it would not otherwise be available. The appointment of medical officers trained and experienced in obstetric and ante-natal work, and the establishment of a careful system of reporting all abnormal conditions to the doctor and midwife who may be concerned in the case, have been found in many areas to obviate to some extent the disadvantages of the lack of continuity of medical responsibility in pregnancy and labour. The lines on which it is considered such clinics may best be organised are laid down in the Memorandum already referred to. (See Appendix.)

Services of Consultants.

120. In addition to provision of routine supervision during pregnancy, consultative clinics, to which general practitioners can send

their patients for an opinion, may usefully be arranged by local authorities, either in co-operation with an adjacent maternity hospital (as is now successfully done in Newcastle-on-Tyne), by the institution of an *ad hoc* clinic served by specialists (as in Middlesex and in certain urban areas in Yorkshire and Lancashire) and if necessary, particularly in rural areas, by arrangements for the payment of a consulting fee in the case of an individual patient who is unable to afford it herself. Such consultations are specially valuable in early cases of toxæmia, cases of recurring ante-partum hæmorrhage or of suspected disproportion between the head and the pelvis. In other cases the services of a physician or of a bacteriologist should similarly be made available. Consultative clinics are considered by the Committee an essential feature of a National Maternity Service.

Provision for Institutional Treatment.

121. In conjunction with systematic ante-natal care, provision for ante-natal treatment of abnormal conditions, including hospital beds, is essential. It has been noted in the section on the Committee's inquiries into maternal deaths that even where some degree of ante-natal supervision has been exercised, the detection of albuminuria, of slight recurrent hæmorrhages, of heart disease or of vaginal discharge is often not followed up by appropriate treatment. With this is closely associated the lack of beds for the treatment of abnormal ante-natal conditions. It appears clear from the reports received that many patients suffering from toxæmia and badly compensated heart disease or from severe malnutrition would have had their chance of safe delivery greatly increased by suitable treatment in hospital, in place of merely receiving advice as to rest, dieting, freedom from worry, etc., which they were totally unable to carry out under their existing home conditions.

The proportion of ante-natal beds to lying-in beds which should be provided in a maternity hospital was stated to the Committee in the *precis* of evidence submitted by the Royal College of Physicians as 1 to 7. Mrs. Ivens-Knowles, representing the Medical Women's Federation, stated that in her opinion, based upon her experience at the Liverpool Maternity Rest Home, a proportion of 1 in 4 was desirable.

Need for Further Education.

122. Certain authorities have urged that ante-natal work, and indeed obstetric work generally, should be done entirely by specialists, but the Committee are of opinion (as expressed in the section on a Maternity Service) that this is neither practicable nor desirable. They recognise, however, that adequate medical supervision on the lines laid down above makes a great demand on the practitioner responsible for it. They consider, therefore, that post-graduate instruction in these subjects should be made available, and that practitioners should be encouraged to attend hospital ante-natal clinics from time to time in order to keep in touch with modern methods of observation and treatment.

With this question is closely associated the need for better education in obstetrics of the medical student, to which a section of the Report is devoted, and with the improved training of the midwife—a question dealt with in the recent report of the Departmental Committee on the Training and Employment of Midwives. Whatever steps are taken in accordance with these recommendations to improve the standard of professional attainments, the education of the expectant mother and of the general public is of primary importance, and still offers a great opportunity for local authorities, through their public health organisation. The death enquiry forms submitted to the Committee contain not a few deplorable stories of disaster due to ignorance or neglect, or a definite failure to follow advice given, on the part of the mother herself.

CHAPTER VI.

THE USE OF ANAESTHETICS AND ANALGESICS
IN OBSTETRIC PRACTICE.

123. The subject of the due place of anaesthetics and analgesics in midwifery practice was brought last year to the notice of the Departmental Committee on the Training and Employment of Midwives, which reported as follows :—

“ We have had brought before us certain representations in regard to the administration of anaesthesia in confinements, and the plea has been made for more general use of anaesthetics both in hospitals and in patients' homes, and, in particular, for freedom of administration in suitable cases, irrespective of the social position of the patient. A considerable amount of misapprehension seems to exist in relation to this matter, and it does not appear to be at all widely understood that the use of anaesthetics and other drugs is not without danger to mother and child in certain circumstances. We think that it would be to the public interest if some professional body would take upon itself the responsibility for issuing at an early date some pronouncement as to the advisability and place in labour not only of anaesthetics, but also of analgesics and sedative drugs generally ” (p. 68).

In response to this recommendation, the Minister of Health approached the Royal College of Physicians of London and the British College of Obstetricians and Gynaecologists, with a request for their opinion, and each body submitted to him a Memorandum on the subject which has been referred to the Committee. The British Medical Association has also furnished them with a document on the matter. The Committee have carefully considered these Memoranda, and have had the further advantage of hearing from a number of expert and experienced witnesses their views on the whole subject. In the present section the matter is discussed in its relation to collateral issues raised in its application to the practice of obstetrics.

124. The use of anaesthetics and analgesics in midwifery practice is twofold; first, to facilitate delivery under conditions of greater or less abnormality—here they are used in a purely medical or therapeutic sense—and secondly, to relieve or abolish the pain associated with normal labour—in which case their use may be partly medical and partly humanitarian.

Anaesthetics in Operative Midwifery.

125. It may be stated in general terms that an anaesthetic should be given in every obstetric operation, including the application of forceps and the suture of the perineum. The form of anaesthesia used will depend on the practice of the medical practitioner in charge of the case, as well as on the circumstances under which the labour is conducted. For all operative work a second doctor, who is responsible for the anaesthetic only, should be present, both to ensure the greater safety of the patient under the anaesthetic and to avoid the risks of sepsis owing to the doctor attempting to fulfil two functions at once.

Anaesthetics in Normal Cases.

126. The matter becomes less simple, however, when the lessening of pain in normal labour is under consideration. The child is expelled from the uterus by rhythmic muscular contractions, and anaesthetics used for the relief of pain tend to weaken and hinder these natural forces. In an uncomplicated labour with a well-balanced and healthy mother it may, therefore, be better, from the purely obstetrical point of view, to avoid interference with the normal expulsive process for the sake of both mother and child. Although the pain accompanying this process has been recognised as one of the heaviest trials of womanhood since the earliest times, many women pass through childbirth without any expressed desire for an anaesthetic, and recover without mental scarring or shock. Others, however, less fortunate or robust, suffer acutely not only at the time, but in retrospect from the memory of a painful labour, especially a first labour, and it is clearly our duty to prevent this prolonged and often agonising pain when it can be accomplished without appreciable risk. In some cases, indeed, where intolerance of pain is very pronounced the administration of an anaesthetic or analgesic may not only relieve suffering, but may even promote rather than retard delivery. Therefore, while we deprecate any wholesale attempt to relieve pain regardless of other considerations, it seems necessary to explore the whole position with a view to considering whether more might not be done to alleviate pain during childbirth.

Choice of Anaesthetics and Method of Use.

127. The evidence put before the Committee by representatives of the medical corporations, as well as by individual expert witnesses, is unanimous in expressing the view that such relief of suffering as can safely be devised should in all cases be available, but that there are well defined conditions governing the safe use of anaesthetics in midwifery. There is general agreement that if the administration is not begun until the second stage of labour is well advanced, and if a light and intermittent rather than a deep anaesthesia is secured, the disadvantages are practically negligible. On the other hand, the prolonged use of anaesthesia from an early stage of labour may lead to failure of uterine contractions and loss of voluntary muscular effort, resulting in premature efforts at instrumental delivery before the passages are fully dilated and to postpartum haemorrhage. Moreover, excessive use of the drug is liable (particularly in the case of chloroform) to cause serious damage to the liver and other organs of the woman. It has also been pointed out that the danger is increased if a second administration be given within a short time of the first, especially if the anaesthetist is not aware of the amount previously used. The inquiries into maternal deaths made by the Committee show that these are real dangers. The consideration of these risks led the representatives of the British Medical Association,

who gave evidence before the Committee, to urge as a necessary safeguard that anaesthesia should not be given as a routine, but at the doctor's discretion in each individual case.

128. Subject to the limitations discussed above, several witnesses expressed the opinion that the humanitarian use of anaesthesia might be considerably extended. Dr. J. P. Hedley, giving evidence for the Royal College of Physicians, stated that anaesthesia to the obstetrical degree and in the second stage only was given to many normal cases at St. Thomas's Hospital. Mr. Carnac Rivett, for the Royal College of Surgeons, reported on the result of two years' experience at Queen Charlotte's Hospital, during which an anaesthetic, similarly safeguarded and subject in each case to medical approval, has been administered to the great majority of normal cases with entirely satisfactory result. Dr. Rhoda Adamson, representing the Medical Women's Federation, gave evidence as to several years' experience at the Leeds Maternity Hospital in the routine administration of anaesthesia under the same limitations to all normal cases who desired it, advantage being taken of this practice to instruct medical students in the proper method of administration for such cases. No material increase in the application of forceps, in perineal lacerations or in post-partum haemorrhage has been experienced, and the results, in diminishing anxiety and suffering, are considered highly satisfactory.

129. The use of pituitary extract in conjunction with light anaesthesia is advised by some obstetricians to counteract the possible effect of an anaesthetic in diminishing uterine contractions. The Committee consider that there is a place for the judicious use of pituitary extract for this purpose in suitable cases under conditions made possible by modern research and effective regulation, viz., that the drug should be pure, standardised and used in definitely limited doses.

130. The Memoranda submitted agree in the opinion that *chloroform*, if given with proper precautions and to suitable cases, is a safe anaesthetic to use in midwifery practice. It is convenient to administer, portable, and not unpleasant to the patient, and for these reasons is likely to remain the anaesthetic most commonly used. *Ether* is the anaesthetic preferred by many practitioners, as certain of the risks associated with the use of chloroform are diminished, especially if the open method is used. Ether has to be administered in a much larger quantity than chloroform, and is therefore less convenient to carry, and its highly inflammable nature strictly limits its use in domiciliary practice. It is less suitable than chloroform for the intermittent method of administration, but probably safer for deep anaesthesia for operative work. Some authorities consider that a combination of *nitrous oxide gas and oxygen* is the safest and least harmful anaesthetic in labour, but its administration requires cumbersome apparatus and special experience. Its use is therefore limited for the most part to hospital practice. It appears to be specially valuable in "failed forceps"

cases, where large amounts of chloroform or ether may have been previously given.

Sedatives and Analgesics.

131. As stated above, there is general agreement that the use of an anaesthetic in normal labour should be restricted to the latter portion of the second stage. Anaesthetics, however, are not the only means of relief. There are various sedative or analgesic drugs which can be used to deaden sensibility or to procure rest and sleep, and which thus safeguard the physical strength and mental endurance of the patient, protect her from undue fatigue and exhaustion, and may even, through their special action on the uterus, hasten the termination of a prolonged labour.

The more important drugs in the analgesic group are opium (with its derivatives, morphine and omnopon), and hyoscine. The special value of the opium derivative drugs is in the first stage of labour, whereas hyoscine is even more useful in the second stage, when, unlike opium, its employment is not contra-indicated. The Memoranda in the Appendix point out that apart from possible danger to the child if opium derivatives be given to the mother within two hours of the birth, the precautions necessary to be used in their administration are the same as in general medical and surgical cases, their danger to the mother being not increased by pregnancy or labour. The particular value of these drugs in procuring rest in lingering cases does not seem to be fully appreciated. Other sedative drugs, such as bromides and chloral hydrate, may be given in full doses in the early stages of labour, and the dangers associated with their administration are not specially modified or increased by pregnancy and labour.

“Twilight Sleep.”

132. Medical opinion is divided as to the desirability of any general use of morphine-scopolamine narcosis. It seems probable that the risk to the child which is said to attend its use is largely due to the association of morphine with the hyoscine, especially during the later period of administration. It has been suggested that the differences of opinion as to the value of this method may be due to variation in the special form of preparation used—scopolamine, which is the laevo-rotatory form of hyoscine hydrobromide, should be employed rather than its dextro-rotatory isomer. Further investigation is evidently desirable to explore the full possibilities of this method and its practicability in ordinary midwifery practice. A Memorandum submitted to the Committee by Dr. S. A. Winstanley on the relief of pain in labour without the use of general anaesthetics suggests that its use might be expanded and simplified in cases of domiciliary practice in which, the doctor can be sure of the assistance of a properly instructed midwife.

Relief of Pain in Midwives' Cases.

133. Perhaps the most difficult practical aspect of this question is to decide how best to relieve the woman confined at home by the

midwife. On the one hand, it is desired to facilitate the employment of the midwife for natural delivery in normal cases; on the other hand, it is important that such patients should not be deprived of the relief which can be afforded by the wise use of anaesthetics, or at least of sedative drugs.

Opinions as to the administration of anaesthetics by midwives are contained in the memoranda supplied to the Committee and may be quoted.

Royal College of Physicians: "At present anaesthetics can be administered only under the direct supervision of doctors, and before departing from this practice careful consideration will have to be given to the matter. Stringent rules would have to be drawn up before allowing midwives or maternity nurses to give anaesthetics for the relief of pain in labour on their own responsibility."

* * * * *

"It is possible that a time may come when the obstetric service of the country may be more in the hands of midwives than it is at present—more confinements may take place in hospitals and fewer doctors may actually be present at confinements, although their ante-natal supervision will be largely increased."

"When that time comes it may be that midwives will possess such a measure of skill and experience that they may be trusted with the responsibility of administering chloroform in labour."

"At present such a practice would be disastrous."

British College of Obstetricians and Gynaecologists: "We recognise that light anaesthesia is capable of being maintained by a properly-instructed nurse, if she be fully certificated, provided a doctor is present to decide that anaesthesia is desirable."

* * * * *

"We do not think it right or proper for a midwife possessing only the C.M.B. certificate to undertake such a duty, for she has neither the knowledge nor the everyday experience of anaesthesia and its results in a variety of circumstances, such as falls to the lot of a fully-certificated nurse."

British Medical Association: "The British Medical Association is of opinion that the midwife should not administer anaesthetics, opium or its derivatives, pituitary extract, or other dangerous drugs, except in so far as she may be acting under or carrying out the instructions of a medical practitioner. It is of this opinion:—

- (i) with regard to *anaesthetics*, on account of the well-known dangers attendant upon their administration;
- (ii) with regard to *opium and its derivatives*, on account of the danger of unrecognised obstruction and the risk to the life of the child; and
- (iii) with regard to *pituitary extract*, on account of the risk of ruptured uterus and the danger to the unborn child."

Medical Women's Federation: "The Committee" (of the Federation) "is of the opinion that anaesthetics should not be given by nurses."

134. In the Committee's opinion it would be inexpedient to entrust the midwife with the power of giving an anaesthetic on her own responsibility. No midwife, working singlehanded, could properly attend to the administration of anaesthesia as well as to the delivery of the patient, nor has she the adequate basis of knowledge of physiology and of disease which is necessary for the safe administration of a general anaesthetic. If, therefore, an anaesthetic is desired by the patient in a normal case attended by a midwife, a

doctor should be present and should be responsible for the administration. If operative interference should become necessary, a second doctor should be obtained wherever practicable.

Although midwives are permitted by the rules of the Central Midwives Board to carry and use opium preparations, they seldom, in fact, take advantage of this privilege. They are not debarred from using other sedative drugs, such as chloral hydrate, on their own responsibility, but here, too, greater knowledge than the average midwife possesses is necessary in order to make safe and effective use of such drugs. The Committee consider that the midwife should be more efficiently taught the indications for the use of analgesics and the benefit to be derived from them, although they are of opinion that these drugs should (except in emergency) be administered only under medical direction.

135. In relation to the desirability or otherwise of using anaesthetics in midwifery, the Committee consider it of the highest importance that those in charge of the case should realise the advantage to be derived from the general care of the patient from the beginning of labour. For example, the judicious use of gentle exercise and rest and of suitable food, etc., and helpful encouragement, such as can be given by the well-trained midwife who has ample time to devote to her patient, are among the most important factors in the conduct of the early period of every labour, and will, by conserving the patient's bodily and nervous energy, materially reduce the necessity and desire for anaesthesia and analgesic drugs. It is by acting upon these principles that many large institutions employing midwives for normal cases have been able to show consistently good results, and the Committee fear that if it were to become the rule that normal cases are, in every labour, to be given anaesthetics from humanitarian considerations only, this care that is so essential to the well-being of the mother might be relaxed, with unsatisfactory results.

136. The Committee believe that if the National Maternity Scheme advised by them comes into operation, the question of freedom of administration of an anaesthetic in suitable cases, irrespective of the social position of the patient, will be solved. For under this scheme every woman would have a midwife in attendance and a doctor would be available for giving anaesthetics when he considers it advisable. Through his ante-natal investigations the doctor would already be familiar with the patient's physical and mental condition, and could instruct the midwife as to the use of sedative drugs in her individual case. He could even inform the midwife beforehand that the case appeared to be one in which his presence would probably be required in order that an anaesthetic might be given.

Conclusions.

137. Having carefully considered the opinions expressed in the Memoranda of the medical bodies and in the evidence of individual witnesses, the Committee consider that light obstetrical anaesthesia

by the intermittent method may, with advantage, be administered to suitable cases of normal labour, particularly to primiparae, to a greater extent than has generally been the practice up to the present time. Such administration should be limited to the latter part of the second stage of labour, and should always be undertaken by a medical practitioner. The Committee believe, however, that it is important to emphasise that any general attempt to increase the employment of anaesthesia in labour may, unless wisely directed and under medical control, lead to an increase in the mortality and morbidity of childbirth. They are therefore of opinion that, even allowing due weight to the natural demand for relief from avoidable pain, the use of anaesthesia in labour must be limited to cases selected by the doctor in charge on the lines laid down above.

138. We suggest that medical students, during their course in practical midwifery in the maternity wards, should be carefully instructed by a competent anaesthetist in giving light obstetrical anaesthesia, a different method from that necessary for securing the deep anaesthesia required for operative surgery. Such training would not only familiarise future medical practitioners with the best methods of employing light anaesthesia, but would enable far greater relief from pain to be given to patients in teaching hospitals and their extern districts than is usual at present. More frequent administration under such conditions would also afford occasion for a critical investigation of the effects of anaesthesia in normal labour on a scale that has been impracticable hitherto. The cost of such provision in hospitals would not be prohibitive, and would, in most cases, if not in all, willingly be met by hospital governors.

CHAPTER VII.

MEDICAL EDUCATION IN OBSTETRICS.

139. The history of the present requirements of the General Medical Council regarding the courses of study or examination of medical students dates back to the year following the establishment of the Council under the Medical Act of 1858. The stages by which the present position of the teaching of obstetrics and gynaecology have been reached are set out in the following notes.

140. Although in 1859 the Council appointed a Committee to consider how far the courses of study and examinations secured the requisite knowledge and skill for the efficient practice of medicine, the place of obstetrics and gynaecology in the course did not receive direct attention until 1867. The first visitation of the various professional examinations was then in progress, and, in the Report adopted in 1867, the Council emphasised the importance of practical examinations in certain subjects, one of which was midwifery. In the same year the Council appointed a Committee of Education to consider the fundamental subjects of which a student should have knowledge, and among the subjects mentioned in the subsequent Report, midwifery was specially noted. A Committee was then appointed "to consider and report how the various subjects of medical education which have been deemed requisite by the Council may be taught with most advantage; in what order they should be studied; and how the examinations on them ought to be arranged." Adopting this Committee's Report in 1869, the Council stated that it was decidedly of opinion that the space allotted to midwifery was too short; that it should extend over one winter session, and that the instructions in practical midwifery should be extended. This report was circulated to the Licensing Bodies, whose replies were considered by the Council in 1870. It was in this year that the demand for six months' clinical study of midwifery was first brought before the Council. Trinity College, Dublin, recommended that each candidate should have studied for six months at a maternity hospital; and the Royal College of Surgeons in Ireland made the same recommendation, with the addition that the candidate should have attended 40 cases of labour. It was not until 1871, however, that the Council really came to grips with the difficulty of securing the proper place for obstetrics and gynaecology in the curriculum, and in this year commenced a series of abortive attempts to improve the position. In 1872 the Royal Colleges of England set up a Committee to arrange and superintend all matters relating to examinations, but there was no teacher of midwifery on this Committee. The Obstetrical Society of London also drew attention to the matter by means of a memorial in 1879.

141. During the Third Visitation 1881-85 there were special Visitors for Midwifery, when the majority of these Visitors commented unfavourably on the midwifery examinations. The new

Medical Act in 1836 took the matter a stage further; for the first time in such an Act Midwifery was mentioned as a necessary subject for qualification. This was an interim triumph for the General Medical Council, especially as the Act placed upon the Council the duty of securing the maintenance of a standard of proficiency in midwifery. But the battle was not yet won. In 1888 the first inspection of midwifery under the new Act took place, and though the Inspector regarded medicine, surgery and midwifery as indivisible subjects, he found in some examining bodies there was a tendency to regard midwifery as of secondary importance, and in practice the system of compensation was followed, which meant that a candidate might be successful though he did very badly in midwifery as long as he did well in the other subjects. The position was so unsatisfactory that the Council passed a resolution in this year (1888) that every student should attend for three months the indoor practice of a lying-in hospital or be present at not less than twelve cases of labour, three of which should be personally conducted under the supervision of a registered medical practitioner. Following this resolution there were petitions to the Council urging them to take steps to increase the educational standard of midwifery, and in 1890 Dr. Rentoul, on behalf of 330 practitioners, forwarded to the Council a petition in which the petitioners begged the Council to recommend that each student should attend a six months' course of lectures in midwifery, puerperal diseases and diseases of women and infants; that each should attend for six months a lying-in-hospital or general hospital with a maternity department at which clinical lectures are delivered; and that each should be present at fifty labours and of these personally conduct thirty. In addition, they recommended that there should be an increased stringency of examinations, having a separate paper, a separate clinical and a separate oral examination in midwifery, diseases of women and diseases of infants. In the same year the Royal College of Physicians of Ireland made a similar demand. And yet at this time the curriculum only lasted four years. As a result, the Council resolved (1890) that the time devoted to the practical part of the examinations in all subjects should be extended, that the curriculum be five years, and that the fifth year should be devoted to clinical study. They further considered that the system of compensation as between the different subjects stands condemned, and that the marks for the written and oral at the final examinations should not, in medicine and surgery, exceed those for the clinical and practical. Still, midwifery was neglected.

142. In 1895 the British Medical Association submitted a petition that no student should be admitted to the final examination unless he had personally conducted thirty cases of labour under direct supervision. This petition followed on a series of failures at attempted reform, but in 1896 the Council recommended that in regard to practical midwifery it was desirable that the alternative to three months' practice in a lying-in hospital should be the attendance at not less than twenty labours, of which five should be personally conducted throughout, including the puerperium, under the

direct supervision of a registered medical practitioner. For several years after this the results of the examinations in midwifery met with the approval of the Visitors, but in 1905 the reports on the examinations appeared to portray so satisfactory a position that some members of the Council became suspicious and a questionnaire was sent to all teaching schools, with most instructive results. It was quite evident that the Rules of the Council were not complied with in the majority of Schools.

143. The Royal College of Physicians, London, appointed a Committee of its Obstetric Fellows in 1906, which regarded the main cause of the insufficient knowledge of medical students in obstetrics and gynaecology as being the regulation which allowed students to take their examination in these subjects one year after their second examination. Following upon this (1907) the Council recommended :—

That a student must attend not less than twenty cases of labour; he must have been a clerk and dresser and attended lectures in medicine, surgery and midwifery; that he must have attended a lying-in hospital for three months and received practical instruction under medical supervision of not less than twenty cases and have had one month's attendance at a lying-in hospital or similar institution, having conducted five cases of labour under the personal supervision of the official medical officer.

The Council also recommended :—

That the attention of licensing bodies should be called to the necessity for instituting clinical examinations in the qualifying examination.

These recommendations of the Council held the field for many years. In 1920, however, the inspector of midwifery reported that candidates knew more about gynaecology than midwifery, and even as regards midwifery were able to describe rare diseases more readily "than common things, such as the management of abnormal presentations and the application of the forceps." As a result of inquiry the Council learned that the difficulty in London as regards compliance with their recommendations was the paucity of cases available for teaching.

144. In 1922 the Council had the whole curriculum under revision and adopted the following recommendation, which came into operation on January 1st, 1923 :—

Midwifery and Diseases of Women.—Instruction during a period of at least two terms, comprising :—

1. Courses of systematic instruction in the principles and practice of Obstetrics and Gynaecology.

2. Lectures or Demonstrations in Clinical Obstetrics and Gynaecology, and attendance on In-patient and Out-patient Gynaecological Practice.

3. Instruction in the following subjects, viz. :—

- (a) Ante-natal conditions,
- (b) Infant hygiene.

4. Every student should, after attending the Courses of systematic instruction in the principles and practice of Surgery and of Obstetrics, give

continuous attendance on Obstetrical Hospital Practice, under the supervision of a competent officer, for a period of three months, during one month of which, at least, he should perform the duties of an intern student in a Lying-in Hospital or Ward. He should attend during the period twenty cases of Labour under adequate supervision. Extern or District Maternity work should not be taken until the student has personally delivered at least five cases in the Lying-in Hospital or Ward, to the satisfaction of his teacher.

A certificate of having attended twenty cases of labour should state that the student has personally attended each case during the course of labour, making the necessary abdominal and other examinations, under the supervision of the certifying officer, who shall describe his official position and state how many of the twenty cases were conducted in Hospital.

The Council added an additional recommendation to the licensing bodies that throughout the whole period of study the attention of the student should be directed by his teachers to the importance of the preventive aspects of the subject.

The Observations of the Committee on the Revised Medical Curriculum of 1923.

145. The Committee have given careful and prolonged consideration to these existing Resolutions of the General Medical Council adopted by the Council on May 26th, 1922, which came into operation on January 1st, 1923, and venture to submit to the Council certain Suggestions for Revision of these resolutions which appear to them to be desirable, and even necessary, as follows:—

A. Courses of systematic instruction in the principles and practice of midwifery (including infant hygiene) and gynaecology, during a period of at least two terms.

B. (1) Every student should, after receiving systematic instruction in the principles and practice of surgery and after having acted for six months as a surgical dresser, devote his whole time to Hospital practice in midwifery (including infant hygiene) and gynaecology for a period of *six months*, during not less than *two* of which he should reside in the Maternity Hospital, or in specially provided quarters adjacent thereto, and perform the duties of an intern student in a lying-in hospital or ward.

(2) He should throughout this period of six months attend clinical lectures or demonstrations in midwifery and gynaecology and in-patient and out-patient gynaecological practice. The instruction during this six months should be so arranged that at least two-thirds of the time is allotted to midwifery (including ante-natal care and infant hygiene), and the remaining one-third to gynaecology.

C. He should attend and personally deliver during the period not less than 30 cases under adequate supervision. A certain number should be extern or district cases, but these should not be taken until the student has delivered at least five cases in

the lying-in hospital or ward to the satisfaction of his teacher. Records of labour and the lying-in-period should be kept and produced at the candidate's final examination.

D. During this six months' period he should receive special instruction in the following subjects:—

- (a) Ante-natal and post-natal conditions, including regular attendance at the out-patient department and the personal examination, under supervision, of not less than 50 pregnant women.
- (b) Infant hygiene, including the care of the infant during the lying-in period and at least eight attendances at an Infant Welfare Centre.
- (c) Diseases and abnormalities of the newly born.

Certificate for Final Examination.

A certificate or certificates that the student has completed his training in obstetrics and gynaecology should state:—

(1) The length of time devoted entirely to a study of these subjects.

(2) The length of time during which the student lived in the Maternity Hospital or in specially provided quarters adjacent thereto.

(3) The number of ante-natal examinations that he has made in the out-patient department.

(4) The number of times he has attended an Infant Welfare Clinic.

(5) (a) The number of women he has attended and delivered, making the necessary abdominal and other examinations, and keeping the case records of labour and of the lying-in period.

(b) The number of these delivered in hospital under supervision of a member of the hospital staff.

(6) Whether the clinical work of the student has been satisfactorily performed.

(7) The official position of the certifying officer or officers.

146. In making these suggestions the Committee have been influenced by the following considerations:—

(a) The Committee understand there is some ambiguity in paragraph 4 of the Council's Recommendation on Midwifery (quoted above) regarding the meaning of "continuous attendance" at hospital and the injunction to "attend" twenty cases of labour. They think it desirable that the recommendation should be explicit and not open to misinterpretation.

(b) The Committee have received a good deal of evidence of variation in practice, and enquiries of different teaching schools have elicited the fact that the minimum requirements are not in all cases being carried out.

- (c) Thirdly, there is in many districts some difficulty in medical students receiving all the practical education that is either prescribed or necessary, because many of the available cases are used in the training of midwives, many of whom have no intention of practising as such.

147. In connection with the proposed amendments it should be pointed out that all the witnesses who gave evidence before the Committee on the question of medical education agreed as to the scarcity of cases for adequate practical teaching of the students, and associated this shortage with the demands made by the training of pupil-midwives. They stated that in many instances the 20 cases required by the General Medical Council to be attended by each student were not available. One witness gave the average at his Medical School as 8, while another found on questioning one class at the end of their course that the average per student was 2·8. The witnesses also drew attention to the need for more effective supervision and teaching in such students' cases as were available, both in hospital and on the district. One or two witnesses put on record their opinion that inadequate opportunity for practical training was a definite cause of mishap in the treatment of complicated cases in subsequent medical practice. They gave as an instance of insufficient practical experience the not infrequent cases to which they were called in consultation in which the practitioner had not diagnosed an imperfectly dilated cervix. The experience of witnesses who had acted as examiners at the Universities confirmed the view that the practical work prescribed was insufficient, although in many cases there was a good theoretical knowledge of midwifery.

148. Actual experience in teaching students shows that the time allotted in the curriculum to the study of obstetrics and gynaecology is not much more than half that allotted either to general surgery or to medicine. It is often argued that medicine and surgery are fundamental subjects, while midwifery and gynaecology are specialities, and that therefore less time should be allotted to them in the curriculum. The Committee, however, cannot admit that midwifery should be regarded as a speciality, whatever may be said of its sister subject gynaecology. A thorough knowledge of midwifery is an essential part of the training of every general practitioner, who, under present conditions, is frequently called upon to treat emergencies arising in midwifery practice, in which disaster may occur unless he has acquired an adequate practical knowledge of the best methods of dealing with them. The general practitioner seldom requires such detailed knowledge of operative surgery, as his responsibility for surgical complications generally ends with diagnosis. It is probable that whatever arrangements be devised for lessening maternal mortality, by far the largest proportion of abnormal cases of midwifery will still have to be treated by the general practitioner.

149. The Committee have therefore drawn up the Suggestions for Revision in para. 145, which they regard as the minimum necessary to ensure that the student is given adequate opportunity to acquire a practical and reliable knowledge of the principles and

practice of obstetrics. While it is admitted that adequate skill in difficult midwifery cannot be attained during student days in hospital or elsewhere by mere observation, but only by actual personal experience in the conduct of abnormal cases such as can be gained in practice, it should be remembered that this limitation applies chiefly to operative procedures. Of methods of ante-natal care, including diagnosis and treatment, a really useful knowledge can be acquired by the student, and if this is obtained the proportion of complicated labours will be considerably reduced and timely arrangements be made for the removal to hospital of cases presenting serious difficulty. Measures must, therefore, be taken to ensure that a high standard of competence is reached in the practical and preventive branches of obstetrics. It is held that this is of so much importance that every examining body should test the knowledge of the candidate in regard to it by means of a *clinical examination* as part of the final examination, and that this examination should be conducted partly by an external examiner.

150. Clinical work is considered of much greater importance than systematic lectures, and no increase in these is suggested. The opinions of teachers differ as to whether lectures should be given before or during the clinical training, and this has been left to the discretion or convenience of the teacher.

151. Our recommendations have been drafted to ensure as far as possible that the student should be given full opportunity for clinical training in obstetrics and gynaecology and especially in obstetrics, including ante-natal care and infant hygiene. It is considered (a) that to ensure adequate training, a period of six months should be devoted entirely to these subjects (with the possible exception of time necessarily spent in attendance at systematic lectures on collateral subjects), (b) that as nearly as possible two-thirds of this period should be allotted to midwifery (including infant hygiene), and (c) that for at least two months out of the six the student should live in the maternity hospital, or in quarters specially provided, to enable him to follow as an intern student during that period all the emergency and other work of the hospital. This the Committee considers necessary on account of the irregular and uncertain manner in which midwifery work generally, and emergency midwifery work in particular, arises, and of the necessity for the student seeing as much as possible of the management of abnormalities. In fixing this period of six months it is taken for granted that not less than forty beds devoted to midwifery cases would be available to every teaching authority.

152. It may be argued that it is difficult or impossible to find time in the curriculum for this six months period. But now that the curriculum has been extended to at least five years, and in the case of many examining boards to $5\frac{1}{2}$ or 6 years, no difficulty should be encountered in finding the necessary time. Indeed, it may be pointed out that in eight British medical schools the six months course of clinical study in midwifery and gynaecology is already in

accomplished fact a routine practice. What can be done in these schools can, we submit, be done in all.

153. In regard to the recommendation that the student should be resident for two months out of the six, it may be pointed out that in two London hospitals and one provincial school three months' residence is already compulsory. In Stockholm (under Professor Forssner) the term of residence is four months. We may add that the opinion of experienced obstetricians and teachers received in evidence by the Committee is almost unanimous that a period of at least six months should be given to the study of obstetrics, gynaecology and infant care, either two or three months of this period being spent in residence in the hospital. The Royal College of Physicians and the British College of Obstetricians and Gynaecologists expressed a definite preference in favour of teaching being undertaken on maternity beds attached to general hospitals with medical schools rather than in separate maternity hospitals. The importance of the number of beds adequate to ensure that the student should see a fair number of abnormal cases was also emphasised. The Royal College of Physicians considered that the minimum was 30 lying-in beds with five for ante-natal and five for septic cases; the Royal College of Surgeons suggested 40; the British College of Obstetricians and Gynaecologists 20 to 40; while Mr. Comyns Berkeley was emphatic that not less than 50 beds were necessary for proper instruction. As to the value of district experience, there was general agreement.

154. Ante-natal work is the foundation of sound midwifery, and we therefore desire to ensure as far as possible a thorough training in this branch of the subject. As ante-natal clinics vary so widely in the numbers of cases seen, it has not been thought advisable to indicate a specific number of attendances at clinics, but rather to fix a minimum number of ante-natal examinations of different women. This number has been fixed at 50, which should ensure an adequate knowledge of ante-natal diagnosis. These examinations should be made under supervision. Most students will see more than 50, but there should be no difficulty in providing this number in any teaching centre, during the six months spent in clinical work. During the entire course emphasis should be laid on the preventive aspects of midwifery, and care should be taken that the student receives adequate instruction and attains a high degree of competence in ante-natal diagnosis and care. (See Memorandum on Ante-Natal Clinics in Appendix.)

155. An important part of the student's knowledge of midwifery is that obtained by delivery of maternity cases. It is believed by the Committee that, generally speaking, the student learns more from a small number of cases delivered under careful supervision than from a larger number delivered without supervision. Nevertheless, they consider that he should deliver altogether at least thirty cases. This seems to be a general opinion among our witnesses, who consider that this is the smallest number that can be recommended,

bearing in mind the need for the acquisition by the student of confidence and competence in diagnosis and in the technique of normal and abnormal delivery. He should be required to keep careful notes of his cases, including his findings at examination, in labour and during the puerperium. It is appreciated that, under present circumstances, it may be sometimes difficult to ensure that as many as thirty cases should be available. A large number of cases are, however, at present absorbed in the training of pupil midwives, many of whom will never practise. Further, there are also many obstetric cases in poor law and other public institutions which are not being made fully available in the training of medical students and midwives. There are also ample opportunities for teaching students in abnormal work in certain special hospitals, which are at present being entirely neglected. It is thought that co-ordination among teaching bodies and local and hospital authorities in these matters would enable the requisite number to be obtained.

156. The desirability of making some arrangements whereby the maternity wards of the poor law hospitals, now transferred to local authorities under the Local Government Act, 1929, could be utilised for instruction of medical students was put before the Committee by several witnesses, and elaborated by Mr. Comyns Berkeley and Mr. Donald Roy. Mr. Comyns Berkeley proposed that arrangements should be made to provide that deliveries in maternity hospitals should be reserved for the instruction of students only, while pupil-midwives, although taking part of their training in maternity hospitals, should deliver their cases in other hospitals. Mr. Roy, on the other hand, thought that the maternity beds in public (poor law) hospitals should be attached to the maternity hospitals for purposes of teaching, and that there were considerable advantages in educating students and midwives together. The matter was considered by the Departmental Committee on the Training and Employment of Midwives, and we desire to express our concurrence in the conclusions and recommendations contained in their Report (paras. 35 and 36).

157. We have made certain recommendations regarding the study of the care of the newly-born child because we feel that the well-being of the child, its right physical development and the prevention of bony malformation are of the utmost importance in minimising the incidence of difficult labour in the next generation, and because the maternity ward provides an opportunity unique during the student's undergraduate career for instruction in this subject. Nowhere else can he systematically study the newborn child and its management. We therefore recommend that instruction should be given in infant hygiene, including the care of the infant during the lying-in period and in the diseases and abnormalities of the newly born. Further, in order to gain an adequate knowledge of the management of young children of somewhat older age, there should be at least eight attendances at an infant welfare centre. We also think that a question or questions on this subject should more frequently find a place in the examination papers in obstetrics and gynaecology.

158. We regard as of great importance the form of certificate or certificates required by the examining bodies to enable the student to enter for the final examination. It is, in our opinion, desirable that such certificate should state precisely the amount of clinical work the candidate has done in the various branches of the subject, and whether this work has been satisfactory, and should indicate correctly the number of maternity cases the student has delivered, and how many of these were delivered in hospital under supervision. The Council should insist on the certificates in each case being signed by the person who has been responsible for the student's teaching, as he alone has an accurate knowledge of the candidate's capabilities and of the adequacy of his training.

CHAPTER VIII.

A NATIONAL MATERNITY SERVICE.

159. For many years the State has been concerned in the problem of maternal mortality. First in the sphere of the Poor Law, and in modern times in the larger field of public health and preventive medicine, there have been signs of anxiety. In the first half of the eighteenth century public opinion was impressed with the high mortality of mothers in childbirth and of their new-born children. More than a century ago medical evidence was submitted to various Parliamentary Committees on the early factory Bills showing the unfavourable effect of industrial employment on the pregnant woman. In the consolidated Factory Act of 1901 endeavour was made (S. 61) to protect the woman who had recently given birth to a child. In the following year the Midwives Act laid the foundation of a safer and more efficient system of practice by qualified midwives. In 1907 the Notification of Births Act, and its extension in 1915, made notification of birth compulsory, and so brought the Health Visitor into the home and enabled her to advise mothers in regard to their own health as well as the care of their infants. Under the National Health Insurance Act of 1911 maternity cash benefit was introduced, and sick benefit during pregnancy and after confinement was made available under certain conditions. Finally, in 1918 the Maternity and Child Welfare Act was passed giving wide and comprehensive powers to local authorities for the preservation of maternal and infant life. Thus was initiated on a national scale the movement in behalf of ante-natal supervision of pregnant women in centres and clinics (900 in number), the establishment of maternity and infant welfare centres (now 2,600 in number) for expectant and nursing mothers, facilities for the treatment of puerperal fever and for convalescence, a supply of milk for nursing mothers, the extension of lying-in accommodation in hospitals and homes (now 2,500 beds provided or subsidised by local authorities), the appointment of maternity nurses and "municipal" midwives, facilities for obtaining medical consultants, and the co-operation between local authorities and the voluntary societies in counties and cities for the provision of nurses and midwives for women in childbirth.

160. There has thus been created under the Ministry of Health since 1919 a maternity service of considerable magnitude. The general and special reports of the Ministry, and particularly those of Dame Janet Campbell* have aroused widespread public interest, and in conjunction with the official circulars of the Ministry have guided and stimulated local authorities and the medical profession in regard

* *Maternal Mortality, 1924* (reprinted 1928), and *The Protection of Motherhood, 1927*.

to this problem. In 1924 the Ministry issued a circular (No. 517) in which occur the following recommendations to local authorities:—

Ante-natal Supervision.—The most important desideratum of a maternity scheme is to secure the adequate professional care of the expectant mother, but this cannot be done unless (a) medical practitioners and midwives are willing to undertake this duty as an essential part of the treatment of every midwifery case which they are engaged to attend, and (b) every mother is willing to accept and follow the guidance of her professional attendant. Ante-natal supervision is required primarily to detect and provide timely treatment for abnormal conditions, but it has an almost equally important function—namely, the education of the expectant mother in the care of her own health and in the proper management of her baby when it is born.

Maternity Beds.—All Local Authorities should make arrangements for the institutional treatment of complicated midwifery cases and for women whose homes are unfit for a confinement to take place therein. Provision for the isolation of infective cases is also necessary. Maternity homes may be established by the larger Authorities, such as the County and County Borough Councils, but the smaller Local Authorities are seldom justified in establishing separate homes, and they should either combine with other Authorities to provide a joint institution or arrange to send patients to an institution elsewhere. Consulting obstetricians may be required in connection with maternity homes or to assist the general practitioner or the midwife.

Domestic Midwifery and Maternity Nursing.—Steps should be taken by the Local Supervising Authorities under the Midwives Act to promote a high standard of practice by midwives and to assist midwives to maintain their efficiency by attendance at post-certificate courses of instruction or otherwise. Maternity nursing by trained midwives should be encouraged whether a doctor is engaged or not, and the employment of unqualified “maternity nurses” should be controlled as far as practicable. It may be desirable to employ specially skilled nurses for the home nursing of complicated cases.

Investigations.—It is desirable that there should be an investigation in every area by a competent and experienced Medical Officer of all maternal deaths, and of all cases of puerperal fever and all still-births and neo-natal deaths, with a view to ascertaining and preventing the causes likely to lead to maternal or infant mortality.

Educational Measures.—The Local Authority should take such means as may be practicable to create an informed and enlightened public opinion in regard to this question of maternal mortality, as no arrangements for prevention or treatment can be fully effective unless the intelligent support of those most directly concerned can be obtained.

161. The question of maternity benefit was carefully considered by the Royal Commission on National Health Insurance, and various proposals for revision were submitted to the Commission by different witnesses. After reviewing this evidence, the Commission came to the conclusion—

“ that the present elements of maternity benefit should be ultimately dissociated from each other, that is to say, any cash payment made on confinement should be separate from the medical, nursing and institutional services of all kinds provided in connection with the condition of pregnancy. The former should, we think, continue to be administered by the Approved Societies. The latter would be provided as an integral part of the medical service and would be administered by the appropriate local authority. The general practitioner, the midwife, the nurse, the specialist and the institution would all take their respective parts in the scheme of extended medical services:

and the Majority Report recommended:—

“That it is desirable that, as soon as funds are available, the scope of maternity benefit should be expanded to cover medical and midwifery services in addition to a cash payment; that the service element should then be administered by the local health authorities and be co-ordinated with the other local medical services; and that a cash element should be retained and be administered in connection with the other cash benefits.”

162. The British Medical Association and other bodies submitted to the Commission proposals to the effect that there should be provision for the attendance of a doctor and midwife at every confinement, and that while the midwife would usually conduct the normal delivery, the doctor would be responsible for ante-natal examination and supervision, attendance at the confinement if difficulty arose, and during the puerperal period as the case required; while consultant and specialist service for difficult cases and provision for institutional treatment when necessary should be provided by the Local Authority under the Maternity and Child Welfare Scheme.

The great advantage of such a scheme is that it gives the practitioner a definite place in the Maternity Service, and, while allowing him to decline midwifery if he desires to do so, makes it possible for him to carry out personally such ante- and post-natal supervision as is required, and to attend the normal delivery or not as he wishes, thus ensuring experience to the young practitioner. It would secure to every woman who is either herself insured or is the wife of an insured man an opportunity of medical supervision from the beginning of pregnancy to the end of the puerperium; it emphasises the importance of ante- and post-natal medical examinations; it relieves the midwife of responsibility which should not rightly be placed upon her, while giving her a proper status and maintaining the interest of her work; it provides trained maternity nursing during the puerperium, and should do much finally to eliminate the “handywoman.”

163. In 1929 the Departmental Committee on the Training and Employment of Midwives set out in their Report (pages 9-12) what in the light of present-day knowledge may be regarded as the ideal provision for the mother in a national maternity scheme appropriately associated with the National Health Insurance. The British Medical Association also in 1929 published a somewhat similar scheme. All these schemes have been before the Committee in considering their reference as well as the data set out in previous sections of their report. There appears to them to be little difference of opinion on the primary point of need (a) for more systematic and skilful ante-natal and post-natal supervision, (b) for making a trained midwife and better nursing available for every woman in childbirth, (c) for an improved provision of medical aid in obstetric emergencies, and (d) for more effective administration of the maternity benefit under the National Health Insurance. In a word, the Committee desire to see the completion of the scheme of maternity services already envisaged by Parliament and in large degree available. A foundation has been laid, and what seems to be

needed is the more adequate co-ordination of the several parts of the scheme designed for an improved and comprehensive domiciliary Service. The Committee are of opinion that it will not be possible ever to secure the full value of the existing knowledge of the science and art of midwifery until there is a unified service in which hospitals, clinics, specialists, general practitioners, midwives, and local authorities are all interdependent units, and that such co-operation can only be brought about by the administrative local authorities, appropriately organised by the Ministry of Health. Such a development of a national maternity service, based on the existing arrangements now in operation though incomplete in scope and sphere, would involve many and divers matters of importance, medical, administrative and financial. The Committee fully recognise that some of these matters lie outside their immediate reference, but they have thought it may be convenient and useful for them to set out the chief points from a medical point of view which they would desire should be considered for incorporation in any comprehensive National Scheme.

A National Maternity Service.

164. The Committee do not consider it within their province to express an opinion on the best method of financing a National Maternity Service. The question, however, of the persons needing provision under a National Scheme, though inseparable from the financial aspect, appears a fundamental one, and the Committee desire to express their opinion that a Service confined strictly to insured persons, would in their view leave untouched a number of women in special need of such a Service, and that it should be the object of a National Scheme to make provision for all persons not in a position to procure for themselves similar benefits by private arrangement.

165. A further general question is that of the administration of a National Maternity Service. Here again the Committee feel it undesirable to express a final opinion, but they take the view that in order to secure satisfactory working of any arrangement which may be devised, it is essential that there should be cordial co-operation on the part of the medical profession and of practising midwives, and that for this purpose some kind of co-opted representation of practitioners and of midwives on the Committees or Sub-Committees concerned should be provided for.

166. The main attention of the Committee has been directed to the nature of the services to be provided, and to the best method of securing for the women of the country readily accessible medical and nursing attendance of the highest standard attainable. In formulating a scheme the Committee have necessarily taken into consideration existing conditions. They have attempted, however, to indicate how the most advantageous use may be made of the knowledge we possess and the material we have at command, bearing in

mind that a considerable degree of elasticity is needed to meet varying conditions in different parts of the country. The service must also be capable of modification from time to time, as our knowledge increases and the personnel becomes more efficient.

167. The type of service envisaged in the schemes previously mentioned commends itself to the Committee. This is based on two main principles—first, that, provided medical ante-natal and post-natal supervision is secured, attendance on normal cases should be the function of the midwife; and, secondly, that with certain important exceptions referred to later in the Report, institutional provision should be made mainly for abnormal cases. The essential services to be provided may be summed up as below :—

(1) The provision in every case of the services of a registered midwife to act either as midwife or as maternity nurse.

(2) The provision of a doctor to carry out ante-natal and post-natal examination in every case, and to attend as may prove necessary, during pregnancy, labour and the puerperium, all cases showing any abnormality.

(3) The provision of a consultant, when desired by the doctor in attendance, during pregnancy, labour and the puerperium.

(4) The provision of hospital beds for such cases as need institutional care.

(5) The provision of certain ancillary services.

168. In the first place it is necessary to draw attention to the responsibility of the expectant mother herself. The Committee's inquiries show that a potent factor in maternal mortality is her neglect to make use of facilities already available. In order to counteract this attitude, it is necessary to educate the expectant mother, to provide free choice of doctor and midwife for her, and to devise a thorough and efficient system of following-up. It is felt that to ensure her co-operation it may also be found advisable to offer some financial inducement, e.g., to pay a portion of a cash maternity benefit in advance.

1. THE MIDWIFE.

169. The provision of a trained midwife in every childbirth, whether a doctor is in attendance or not, will not only add greatly to the safety and comfort of the mother, but will, it is hoped, eliminate the employment of ignorant and untrained "handywomen," a problem of pressing importance which has proved most difficult to deal with by restrictive and penal measures.

170. The duties of the midwife and her relation to the local administrative bodies, including representation on a local advisory

committee, will require exact definition, but on broad lines we think her duties under the scheme should be:—

- (a) After booking the patient, to inform the local administrative body, and to arrange for the specified medical ante-natal examinations on the lines laid down in the Memorandum on Ante-Natal Clinics (see Appendix), and thereafter to keep the patient under supervision, carrying out such investigations as are to be prescribed and giving general hygienic advice, and when any abnormality is found or suspected to refer her to the doctor who is responsible for the case.
- (b) To attend the patient during labour and to give her adequate nursing care during the subsequent fourteen days, sending for the doctor in any case of abnormality on lines similar to those at present laid down by the Rules of the Central Midwives Board.*
- (c) To advise the woman as to the advantages of the post-natal medical examination to which she would be entitled.

171. In order that a sufficient number of well-trained midwives may be forthcoming to carry out with increasing success the duties on an extended scale here suggested, questions as to their training and status, and the conditions under which they work, must inevitably be considered. These questions have recently received detailed consideration in the Report of the Departmental Committee on the Training and Employment of Midwives, and the Committee are in general agreement with Parts 3 and 4 of that Report. They would like particularly to emphasise the recommendations in paragraph 37 relating to the provision of courses of post-certificate training (which they consider should be obligatory), suitable arrangements for relief for off-duty time, annual holidays and sick leave; and the limitation of the number of cases to be attended in one year to 100 or 110. The Committee also recommend an age limit of 60 for midwives employed under the scheme. This would involve the provision of superannuation allowances.

As regards the supervision of midwives, the Committee are in general agreement with the Midwives Report. They feel strongly that closer helpful supervision of the midwives' work is required, that the Supervisor should be one who has been in the active practice of midwifery herself, and that the district of which she has charge should not be so large that she cannot get to know her midwives personally and visit them frequently to help and inspire them in their clinical work.

* The frequency with which the services of a doctor are called upon by a midwife under the Rules of the Central Midwives Board is a matter of some interest in this connection. In England (excluding Wales) in 1928 approximately 353,002 cases were attended by midwives. In 25·3% of these cases the midwife summoned medical aid, the variations being from 21·83% in London to 25·3% in county boroughs and 26% in county areas. The records of the Queen Victoria Institute for District Nursing for the year 1928, as submitted to the Committee in evidence given by the Midwives' Institute, showed a percentage of 25·2 medical aid calls on a total of 65,077 cases.

The Committee are of the opinion that it is advisable that all midwives should eventually be drawn from the ranks of State registered nurses, and hope that the improved conditions which will be obtained for midwives, if the recommendations of the Committee on the Training and Employment of Midwives be adopted, will hasten the day when such limitation will become practicable. The special difficulties of providing a service of midwives in rural areas is considered below.

2. THE MEDICAL PRACTITIONER.

172. The provision of adequate medical services under the scheme is of great importance and calls for consideration. The good standard of midwifery work carried out for small return and under most unfavourable conditions by a majority of medical practitioners must be generally recognised, but it is undoubtedly the case that the handicap under which most of their midwifery work is performed is a heavy one. The doctor often works with lack of medical and nursing help, with lack of time, with lack of convenient surroundings and suitable equipment, and these conditions inevitably tend to an unsatisfactory standard of work, to neglect of ante-natal supervision, to undue haste and unduly frequent use of instruments with consequent increased risk of laceration and sepsis, and to a higher mortality and morbidity rate than would be attained under better conditions.

173. The Committee have considered in another section of this Report the question of improved education in obstetrics for medical students. They are of opinion that the meagre practical experience obtained during training aggravates the difficulties, due to adverse economic conditions, which confront doctors in general practice. It is only by the adoption of a system providing for adequate payment and for close co-operation between all parts of the Service, supplemented by better educational facilities, that in the view of the Committee material improvement can be effected.

174. The possibility, in the interests of an improved standard of obstetric practice, of confining work under the Scheme to a selected panel of practitioners with special experience of obstetrics, received careful consideration, but the Committee are convinced that such discrimination would be both unwise and impracticable as a method that could be made generally applicable under all conditions, and that any registered medical practitioner should be free to take part in the work or to abstain from doing so. In particular, the facts that over a considerable area of the country the local practitioner is the only man available, and that even in more thickly populated areas the nearest doctor must be called in many cases of emergency, render it specially desirable to include the bulk of the profession in this service. In effect, the Committee consider that the aim should be the raising of the general standard of midwifery knowledge and practice in the whole profession, together with an ample provision of high-class consultants, rather than to encourage a special branch of practitioners, who would necessarily be few in number, and therefore not

readily available for all emergencies. The Committee, however, consider that in areas where local conditions are favourable, selected medical men or women working in conjunction with extern departments of training hospitals or with ante-natal clinics of local authorities might participate in the service so long as the mother retained her right to free choice of doctor. The Committee are of opinion that the conditions and special requirements of the service will tend to keep the practice of midwifery in the hands of those who are keen on the work, and will thereby tend to raise their standard of practice. Among such conditions they envisage—

- (a) The formal and individual acceptance by the practitioner of service under the scheme.
- (b) The furnishing of such full and careful reports as shall be prescribed.
- (c) The setting up of an Advisory Medical Committee with representation of the local profession and of obstetric consultants and of machinery whereby unsatisfactory service can be investigated.
- (d) The provision of special post-graduate courses in obstetrics.

It is recognised by the Committee that the number of normal cases conducted by a doctor under the proposed arrangements may be small, and that his experience may thereby tend to be unduly restricted. They think, however, that this objection is outweighed by the general advantages of the scheme. Moreover, they feel that the deficiency will be to a great extent made up by the doctor's private patients, by patients who, at their own expense, retain the services of a doctor, and by cases where he is called by the midwife for slight abnormality, and that by this means it will be ensured that he sees a number of naturally terminated labours sufficiently large to keep him in touch with the normal course of labour.

175. As to the method of payment for the doctor's services the Committee think it important that it should be such that a doctor doing good ante-natal work should not find his income diminished by the lessening of the number of cases requiring his attendance during labour, nor should a premium be put on premature interference with the course of labour. An inclusive fee for each case undertaken by the doctor might, therefore, be preferable to a fee for special services rendered. On this point it would be desirable to obtain the opinion of the medical profession. If, however, the latter system is preferred, the Committee does not feel that the present scale of fees paid by Local Authorities under the Midwives Act could be adopted without revision.

176. The duties to be undertaken by a doctor who signifies his intention of accepting service under this scheme, as defined by the Committee, are generally—to give the prescribed attendance to every eligible woman who expresses her wish for him to do so, to inform the local administrative body that he has "booked" her, and to make the required reports. It is understood that his responsibility

for mother and child extends from the date of booking until the end of the puerperium. It is regarded as important that, so far as practicable, the patient should make free choice of doctor and midwife. The doctor's specified duties will be:—

(1) To make in all cases for which he has accepted responsibility such ante-natal examinations as may be prescribed, and also to see and advise patients whenever they are referred to him by the midwife for any abnormal condition arising out of the pregnancy. It is anticipated that the specified examinations will be such as are laid down in the Committee's Memorandum on Ante-Natal Clinics, viz., a general medical examination early in pregnancy (about the sixteenth week), and special obstetric examinations at the thirty-second and thirty-sixth week. After such examination he will report according to the prescribed method and state his opinion whether—

- (a) The case appears to be normal and can properly be attended at home by the midwife.
- (b) There are such abnormal conditions as make it desirable that the doctor should be present at the confinement in the patient's home.
- (c) Further ante-natal examinations or treatment (*e.g.*, dental treatment) are necessary.
- (d) There are such circumstances or abnormalities present as make it desirable that the patient should be admitted to hospital either for ante-natal treatment or for delivery.

(2) To attend the patient in any abnormality of pregnancy, labour or the puerperium, either by previous arrangement or where called in by the midwife.*

(3) To conduct the specified post-natal examination. The post-natal examination would be carried out under ordinary circumstances from fourteen to twenty-eight days after the confinement. It would comprise a thorough investigation of the pelvic organs for the detection of any damage, displacement or infection. It would further include a complete investigation of the general medical state, and would be directed to the detection of any defects of the urinary system (*e.g.*, cystitis, pyelitis, nephritis), heart, lungs, etc., caused or aggravated by the childbearing or childbirth, and of any such or other defects—for example, infection of the teeth, tonsils, etc.—as may have been noticed during the pregnancy. Cases of difficulty would be referred to a post-natal clinic or other suitable institution.

177. As to the relation of the doctor's duty in the matter of ante-natal care to the work of ante-natal clinics, the Committee is of opinion that it is a principle to be acted upon, wherever possible, that the person responsible for ante-natal supervision should be responsible for attendance during labour. They agree, however,

* The puerperium is defined as covering a period of 4 weeks from the date of delivery.

that in order to avoid any hiatus in the important work which ante-natal clinics are now carrying out it is necessary that they be continued, but they anticipate that as the service becomes fully developed the clinics will lose to a great extent their character of routine clinics and be used more and more for consultations between general practitioner and specialist. Apart from their medical aspect, the clinics take an important place in the teaching of the midwife and the education of the mother, and their use is at present necessary in the practice of midwives who are unable to do ante-natal work of the required standard.

178. The position of a woman who desires the attendance of a doctor under conditions not postulated in the scheme received consideration. The Committee recommend that any person included in the service, who wishes the doctor to attend at the confinement under these circumstances, should be free to arrange for this at her own expense and still avail herself of the services of the provided midwife. The relation of this point to the question of the use of anæsthesia in normal cases purely for alleviation of pain has been considered in the section of the Report dealing with anæsthesia in obstetric practice. The Committee recommend that in abnormal cases the scheme should make provision where necessary for the attendance of a second doctor to act as anæsthetist. It would also be possible to arrange that the doctors working in the service should undertake for a fixed fee to give an anæsthetic in normal cases at the desire of the patient, provided that there were no contra-indications to its use.

179. The important question whether the treatment of abnormalities found as a result of post-natal examination could be made a charge upon the scheme was considered. The Committee realise the heavy expenditure that would be involved, but agree that if the incidence of chronic ill-health from morbid conditions is to be diminished, some provision for the treatment of such cases is essential, and that no maternity service can be considered complete unless it assures such provision, which can, no doubt, in many cases be secured by arrangement with existing agencies, *e.g.*, with the gynaecological departments of general hospitals. They consider, however, that such treatment should be provided under the scheme only in cases noted by the practitioner at the specified post-natal examination.

3. CONSULTANT SERVICES.

180. The provision of facilities for specialist help and advice in difficult cases is one of the great needs of an improved service. It is being met to a small extent by the efforts of Local Authorities, who are empowered to pay fees for certain cases under the Maternity and Child Welfare Act. The Committee think that adequate facilities for consultation in pregnancy, labour or the puerperium should be an integral part of a Maternity Service, and should be available whenever the doctor notifies to the local administrative

body his desire for such assistance, special arrangements for retrospective approval being made in cases of emergency. At present these facilities, especially in country districts, are to a great extent lacking, and the provision of departments with specialist services in the smaller general hospitals is greatly to be desired and encouraged.

4. INSTITUTIONAL TREATMENT.

181. The provision of hospital beds for such abnormal cases as in the opinion of the doctor require institutional treatment, with the necessary consultant services and skilled nursing and laboratory facilities, is still far from general, and will necessarily form part of an adequate service. Institutional treatment, unless otherwise available, will be needed for abnormal ante-natal conditions and intercurrent diseases, for cases of abortion or miscarriage and for complications of labour and the puerperium, together with special provision for treatment of septic conditions and venereal disease during pregnancy, labour and the puerperium, for gynaecological treatment of post-natal conditions and for convalescent treatment.

182. How far provision should also be made for normal cases is a question which received full consideration by the Committee. Though the records of many maternity homes show years of freedom from any serious infection, the history of various outbreaks of puerperal sepsis in institutions emphasises the extreme difficulty of checking the spread of such infection once it is introduced, and the Committee realise that the aggregation of maternity cases is by no means free from risk. On the other hand, the records of many old-established district maternity charities and district nursing associations show the excellent results which may be obtained at the patient's home even in unfavourable conditions. The deplorable housing conditions and overcrowding in some areas of both town and country must, however, be taken into account, conditions in which no doctor or midwife can reasonably be expected to take the responsibility of attending a patient. And to these must be added the cases where patients are homeless or living in lodgings or with their relatives, where the home is in a remote area far from doctor or midwife, or where, as is increasingly common nowadays, the patient herself desires, in order to obtain quiet, convenience, comfort and good nursing, to be confined away from her home. The importance of the admission of a proportion of normal cases to institutions in order to provide that full opportunity for training both doctors and midwives, which is essential to the success of a National Maternity Service, must not be overlooked. The general conclusion of the Committee in this matter is that certain considerations make it advisable to provide for the admission of normal cases to institutions on account of inadequate accommodation, unsuitable housing, inaccessibility or personal preference for hospital, and for these some financial help should be available under the scheme. It is to be hoped that the transfer of Poor Law Institutions to Local Authorities under the Local Government Act will facilitate the provision of beds for maternity patients.

183. One other point which arises in connection with institutional treatment is the method of medical staffing in the smaller maternity homes and hospitals. The advantages to the general practitioner of facilities for continuing the care of his patient in an institution are undeniable. The patient may be loth to be transferred to another doctor, and the doctor may be unwilling to relinquish the case or to lose the opportunity of increasing his experience. But against this must be set the great difficulty, and in some cases the danger, which may arise from the management and administration of an institution where a large number of practitioners of varying standards of experience and knowledge are in medical charge of the patients. The solution of this problem is not easy, and the Committee suggest that a method should, if possible, be devised whereby in maternity homes and hospitals unified medical control could be arranged either by the appointment of one practitioner to be responsible for the standard of work of the hospital in co-operation with the practitioner actually in attendance on the case, or by some other means.

5. SICKNESS BENEFIT, NURSING, ETC.

Sickness Benefit in Pregnancy and the Puerperium.

184. The bearing on maternal health, and therefore on maternal mortality and morbidity, of the arrangements under the National Health Insurance Acts has been brought to the notice of the Committee, and evidence in the matter was given before them by Dr. Fulton, Divisional Medical Officer, and Drs. McKendrick and Orton, Regional Medical Officers, Ministry of Health.

At present the insured pregnant woman is entitled to no benefit in respect of her pregnancy unless she has been certified as incapable of work by reason of some specific disease or bodily or mental disablement. Sickness benefit is in this way available at any period of pregnancy if continuance in employment be declared definitely prejudicial to her health. But a judgment on this point affords room for great difference of medical opinion. Moreover, there are many discomforts and inconveniences during the last month, or last two months, of pregnancy which may render employment undesirable though not actually harmful. Some doctors certify such cases as eligible for sickness benefit, and some Approved Societies, though by no means all, accept such a certificate without question.

Whether the pregnant woman would materially benefit in health by a compulsory cessation of work at a given period of pregnancy, with earlier maternity benefit, depends so greatly on the nature of the work, the character of the pregnancy and the domestic circumstances that the Committee consider a medical opinion on general lines can hardly be given.

During the four weeks after delivery, maternity benefit is payable, no sickness benefit can be claimed, and industrial employment is forbidden. At the end of four weeks a woman is not entitled to sickness or disablement benefit unless her physical or mental con-

dition is such that she can properly be certified as incapable of work within the meaning of the National Health Insurance Act.

The Committee have not yet been able to give full consideration to this important question, but hope to include recommendations in their final report.

Provision in Rural Areas.

185. Another matter of special interest and no small difficulty is the position of rural areas under a scheme such as that outlined by the Committee. This is particularly so as regards the provision of midwives. Any system of payment based on the number of cases to be attended by a midwife during a year which may reasonably be applied to populous areas naturally fails entirely when applied to scattered country districts. For instance, in one county reported to the Committee the average number of cases per midwife, including towns, was under twenty per annum. An independent midwife is unable to make a living with so little practice, and even if the Local Authority subsidises her the result is not, as a rule, satisfactory, as the cases are often too few to enable her to maintain her experience or to do more than form for her an incidental occupation. The Committee are opposed to such partial employment.

By far the larger part of the rural areas of the country is at present served by district nurse-midwives working under district nursing associations, most of which are in turn affiliated through the county nursing associations to the Queen's Institute for District Nursing. Though an admirable standard of work is maintained by these rural nurse-midwives, as shown by the figures of those affiliated to the Q.I.D.N., it is difficult at present for the county associations, even with the subsidies given by many County Councils, to maintain these services and to establish greatly needed new associations. In such country districts it appears that payment for the services of midwives would need to be worked out in the form of an increased subsidy to the associations. The provision of motor transport often enables a nurse to cover a wider area, and is to be encouraged.

District Nursing.

186. The question has been raised whether general district nursing and midwifery can be combined by the district nurses without risk of puerperal infection. Long experience of this system shows that under careful rules made by nursing associations and by Local Supervising Authorities restricting the type of case which may be attended by a midwife in her capacity of general nurse there is practically no disadvantage, and the advantages in serving country districts are manifest. The Committee have therefore no evidence to show that it is undesirable for a district nurse to undertake both midwifery and general nursing, provided that she is properly qualified and that adequate precautions are laid down by the nursing association and the Local Supervising Authority and observed by the nurse.

187. A scheme has been before the Committee showing that in certain counties the services available might be greatly extended and improved by co-operation between Cottage Hospitals and Nursing Associations. The Cottage Hospital would in such a case serve as a centre of a definite area, providing headquarters for the district midwife, who would benefit by the supervision of the matron, by arrangements for relief duty, by the provision of suitable accommodation, of improved equipment and of facilities for sterilising material. The success of the scheme would necessarily depend on the willingness of the Cottage Hospitals to co-operate and to set aside accommodation for maternity cases, the provision of which should be encouraged by appropriate financial aid. The system seems to promise well in suitable areas, but the conditions in different counties and even in different parts of the same county are so variable that no one system is adapted to all, and possibilities in each locality must be considered on their merits. Whatever system is adopted, the services of consultants and other facilities at the disposal of the larger hospitals might be made available by special local arrangements for all small Maternity Homes and Hospitals.

6. MISCELLANEOUS.

188. In addition to the matters already dealt with the Committee have considered many points of detail as to the working of the Scheme, but they do not consider all these points suitable for embodying in their Report until the main principles are decided. Reference may, however, be made here to certain special subjects.

189. The Committee are impressed with the need for increased facilities for both doctors and midwives to attend revision courses in midwifery, so as to keep their knowledge in touch with modern developments, and they consider that such courses should be arranged in connection with a National Maternity Service.

The question of improved education of students, particularly in practical obstetrics, is referred to in this Report, and the Departmental Committee on the Training and Employment of Midwives has considered the question of education in relation to midwives. In this connection the probable effect of a National Maternity Service on the provision of facilities for clinical teaching, particularly with respect to district midwifery, cannot be ignored, as it may well be that fewer women will apply for treatment under the auspices of training institutions when a private doctor and midwife are available in every case. The Committee consider that this matter should be borne in mind when improvements in practical teaching are under consideration. They also wish to record their opinion that the attendance of a qualified midwife at labour and during the puerperium, in addition to the medical student, is of great importance, and that payment for such attendance should be a charge upon the scheme.

190. The inclusion of cases of abortion or miscarriage among maternity cases for which provision is made under the scheme, is

strongly recommended by the Committee, as facilities for the treatment of this condition are at present inadequate and the mortality and morbidity rate is considerable.

191. Arrangements whereby the services of a suitably equipped laboratory are available for investigations desired by the doctor are considered by the Committee to be necessary.

192. The Committee are of opinion that sterilised outfits should be provided under the scheme in all cases where the attendant considers it desirable.

193. Provision of transport and telephone facilities, already referred to in the Midwives Report, is considered by the Committee to be of great importance in rural areas.

194. Another matter of importance in relation to the mothers' welfare is the provision of "home-helps." Domestic assistance is often needed during the lying-in period, and when there are abnormal conditions calling for rest during pregnancy the persistence of the mother in her usual household work may be definitely detrimental to her health and on occasion dangerous to her life. A service of home-helps has been provided by some Local Authorities and found to be of value, and the Committee recognise such provision to be a desirable addition to a National Maternity Scheme.

Conclusion.

195. The Committee, owing to its composition, has had the advantage of discussing this question from many angles, and has given special consideration to the practicability of its recommendations. The members feel that in formulating the views expressed in this chapter they are not putting forward a merely theoretical scheme, but have been able to consider on a broad basis the factors which should make for the success of a National Maternity Service.

The Committee have given careful attention to certain questions of administration and finance involved in putting these proposals into practice, but they do not consider any recommendations on this aspect of the matter within their reference.

CHAPTER IX.

CONCLUSIONS AND RECOMMENDATIONS.

The Wide Social Aspect of the Problem.

196. A perusal of the text of this Report will indicate in no uncertain degree the gravity of the problem with which it deals. For here is an issue which involves the birth-rate and survival of a nation. It is true that it is concerned with the natural process of reproduction, a physiological function, yet it has been known from the earliest times that the discharge of that function entails manifold risks to mother and infant. The sphere of the physician is to assist Nature in such a way as to reduce any such perils, to remove as far as may be such hazards, chances and accidents, and by applying all the resources of the science and art of Medicine to protect both mother and child in the event. In each confinement two lives are involved; both must be safeguarded. The history of midwifery is the long story of that attempt, all too often, owing to a concatenation of conditions and circumstances, an attempt that has failed. Its failure may entail a fourfold evil: (a) a high maternal mortality, (b) the subsequent invalidity of the mother, (c) a relatively large number of still-births, or (d) an excessive immediate or early mortality, or later morbidity, among the infants born alive. When it is suggested that the loss by death of some 3,000 mothers a year in childbirth out of six or seven hundred thousand confinements is a negligible or inevitable loss, it is forgotten that this loss is largely of women, most of them young, at their reproductive zenith, making their supreme physical contribution to their day and generation, each of them the mother of a home and the upbringer and trainer of a family. The death of such a mother may well be a calamity to home life and to its integrity, perhaps the most grievous of all misfortunes and dislocations which can afflict her husband and children. Moreover, the knowledge of these disasters is apt to produce in many women and their husbands a fear of maternity, with a deterrent effect on the birth-rate.

197. The official returns respecting death in childbirth are recorded in the first pages of the Report. The medical causes to which they were attributed by the medical practitioner in attendance are various, and are discussed in the preceding pages. While the Report is based upon a study of 2,000 particular cases of death, we have, as a Committee of medically qualified persons, always had in mind the fact that these 2,000 cases are representative of the maternal problem as a whole as it presents itself year after year in common experience. Every year some 650,000 women undergo the task and privilege of childbirth. Whilst it has been our business to explore, and confine ourselves almost exclusively to, its medical aspects, we are not unmindful of the complexity of the issues involved in the

problem and its solution, biological, social, economic and administrative as well as medical. We recognise that it has a large human relationship, something social as well as medical. The advantages and disadvantages, the gains and losses, in a matter of this kind are something infinitely wider than the ordinary scientific problems of the aetiology and treatment of disease. The stories of the end of life told in these reports (and dealt with in these pages), usually briefly, but sometimes with graphic detail, convey a peculiar sense of tragedy. Any series of deaths may create this social apprehension to some extent, and almost equally unhappy histories occur in fatal cases of ordinary acute illness or accident. But in such cases the risk or event of death usually happens suddenly and unexpectedly. It is not foretold and not foreseen. There is no self-imposition, fore-warning or time for preparation, as there is in childbirth. Death in child-bed engenders a remorse, a conviction of wasted opportunity, a perception of how much might have been done to avert the fatal issue, a profound regret for an absence of willing co-operation of all concerned to safeguard life itself. All this deepens the impression of drama and the futility and unwisdom of personal and national unpreparedness when the lives of women in childbirth are at stake.

198. In some instances, as is described elsewhere, the mishap, accident or disaster is due to definite error or neglect on the part of someone or something, whether doctor, midwife, medical service, institution, or the patient or her friends. But in a far larger number of cases death in childbirth is not due to any single outstanding mistake, but rather to a number of minor happenings, the overlooking of details, small faults of omission rather than commission, lesser errors of judgment, social circumstances, and so forth. None of these is perhaps highly important in itself, but taken together they lead to a standard of midwifery practice lower than it should be for reasonable safety. In association or combination they may prove sufficient to tip the scale against the mother when the conditions are unfavourable. In a word, this is no ordinary medical issue by and of itself; it is an issue of civilisation in origin and in solution.

The Medical Aspects.

199. When we turn to consider the medical causes of death in childbirth we find them both varied and changing, though the death rate is remarkably constant. They fall into two obvious groups: first, the causes which are *puerperal* and due to conditions arising directly from pregnancy and childbirth, and, secondly, *non-puerperal*, intercurrent disease, whether cardiac, alimentary, renal, respiratory or other. If examined over a quinquennium or a decennium the incidence of these causes, and the factors which contribute to them, are liable to difference in nature and degree, particularly, of course, in the non-puerperal group. No doubt the activities of the Local Authorities and the medical profession are exerting beneficial effect on both groups, but the ground which is gained in one direction at one period seems to be lost in another direction at another period.

There are also differences due to locality, industrial occupation, dietary of women, incidence of rickets, impaired physique, etc. In 1918 the epidemic of influenza claimed its toll, and the non-puerperal mortality increased fourfold. Puerperal sepsis seems to be entrenched, and was the attributed cause of a higher death rate in 1929 than in any year since 1911, with the exception of 1920. It furnished no less than 33 per cent. of the 2,000 deaths examined by the Committee. The number of deaths attributed to abortion differs from year to year and from district to district; and similar variations occur in operative shock and in uterine haemorrhage. Possibly some of these differences are directly or indirectly due to methods of terminology and classification used, others are due to social circumstances, habits or customs. The regional distribution of maternal morbidity and mortality in England and Wales, as Dame Janet Campbell pointed out in 1924, is far from being uniform,* and further inquiry into such unequal distribution may be feasible when the administration of the new Local Government Act, 1929, is developed and stabilised.

The Primary Avoidable Cause of Death.

200. We have given particular attention to the question of determination of the primary avoidable cause of maternal mortality. After deducting from the 2,000 cases considered the deaths due to non-puerperal disease, and excluding those attributed to abortion and extra-uterine pregnancy, the total number of deaths directly due to childbirth is 1,408. In many cases several factors contributed to bring about a fatal termination, and the Committee considered that as the object of sound and skilful midwifery is to prevent deviation from a standard normal of practice (described in the Report) rather than to treat the abnormal after it has arisen, information of the greatest value was obtainable by discovering the first or predominant point at which such deviation occurred, whether before, during or after the birth of the child. In every case where the information warranted it, therefore, they selected the *primary avoidable cause* in the train of events which led up to a fatal issue. These avoidable causes, or "factors," fell into four groups: (a) absence of ante-natal care, in 17 per cent. of cases; (b) errors of judgment in practice or treatment by doctors or midwives, in 17 per cent.; (c) lack of reasonable facilities available for effective medical care, 5 per cent.; and (d) negligence of the patient or her friends to adopt or carry out medical advice, 9 per cent. This gives a total of 48 per cent. of deaths which seem to us to have been directly preventable. It leaves 52 per cent. of the deaths in which no preventable factor actually emerged. With regard to a number of cases in this last group, it must be said quite definitely that a fuller knowledge of the exact circumstances of death would probably have revealed a primary avoidable factor. In summary, our finding is that of the cases of death brought under our notice *not less than*

* Maternal Mortality, 1924, pp. 12-30.

one half were preventable. These matters are fully discussed in the text and tables of the Report.

Conclusions.

201. Our suggestions and advice on numerous points will be found in the text of the Report. Generally speaking it seems clear that the cumulative experience of a generation suggest that the solution to the complex problem of maternal morbidity and mortality will be found in an all-round tightening up as well as strengthening of each link in the chain of obstetric supervision, an increased watchfulness over all stages of pregnancy and labour rather than in any single, arresting or comprehensive remedy. Much of this improved supervision will come about gradually as the education and training of the medical student and the midwife equip them to appreciate the importance of painstaking attention to detail as well as to understand and apply the scientific methods of sound treatment.

202. The influence of a better informed public opinion and the effect of education on the mother herself, whether through direct instruction or the indirect effect of a readily available and adequate Maternity Service, should also prove beneficial in securing a higher standard of practical midwifery. It is indeed essential to preserve a due sense of proportion in dealing with this question. It is useful and necessary to pursue our search for the causes of infection and danger along many paths, but although valuable and helpful information will certainly emerge from bacteriological or pathological inquiry, these results can never be wholly fruitful unless the individual care of the patient as a whole and in every way makes steady advance. *It is certain that an excessive maternal mortality can be prevented, for in some lying-in institutions and in large groups of women in confinement at home it is already being prevented by these very means. What is being done for some women can and should be done for all.**

* The following figures will serve as an example of the excellent results which can be obtained:—

British Hospital for Mothers and Babies, Woolwich.—Years, 1924-28 inclusive. Hospital and district cases: 4,221. Maternity mortality rate: 0.71 per 1,000 births.

Clapham Maternity Hospital.—Years, 1926-29 inclusive. Hospital and district cases: 4,705. Maternal mortality rate: 1.05.

Collin's Trust Maternity Home, Nottingham.—Years, 1921-29 inclusive. Hospital cases only: 2,606. Maternal mortality rate: 1.5.

East End Maternity Hospital.—Years, 1921-28. Hospital and district cases: 17,525. Maternal mortality rate: 0.68.

General Lying-in Hospital, Lambeth.—10 years, 1920-29. Hospital and district cases: 25,906. Maternal mortality rate: 1.31.

Jewish Maternity Home, Stepney, E.—Years, 1925-29 inclusive. Hospital and district cases: 2,750. Maternal mortality rate: 0.72.

Leicester and Leicestershire Maternity Hospital.—Years, 1925-29 inclusive. Hospital and district cases: 3,440. Maternal mortality rate: 1.2.

Lincoln City.—Municipal Maternity Home and District. 10 years, 1919-29. Cases: 5,836. Maternal mortality rate: 1.02.

Queen's Nurses.—Year, 1928.—District midwifery cases: 65,077. Maternal mortality rate: 1.9.

203. It seems to the Committee a reasonable hope that as antenatal diagnosis becomes more widespread and efficient, as specialist domiciliary service becomes more easily obtainable, and as institutional treatment for abnormal cases becomes more accessible, the amount of difficult midwifery performed under unsuitable conditions will steadily decrease, and with it the death rate.

The principal Recommendations we have to make are four, as follows:—

I.—THE EDUCATION OF THE MEDICAL STUDENT IN OBSTETRICS.

204. There can be no question that the effective teaching of this subject stands in the forefront of the student's needs. For, first, every practitioner must know thoroughly well and in a practical way how to conduct safely a case of labour, particularly a complicated case. The need is absolute. Capacity in this respect is comparable to capacity to deal with the commonest emergencies of minor surgery, and no qualified medical man in ordinary practice can possibly afford to be incapable in either matter. That 60 per cent. of confinements in this country are conducted by midwives does not affect this fact, for the remaining 40 per cent. fall to medical practitioners, and the midwife is required by statute to call in medical aid in all complicated cases.

The Committee consider the Revised Curriculum recommended by the General Medical Council, which came into operation in 1923, as a great improvement on all previous medical curricula officially recognised, but in their opinion it still fails to allow sufficient time and occasion for the adequate education of the student in *practical* obstetrics. They concur with the view expressed by the Royal Society of Medicine in 1919 that "the practical instruction leaves much to be desired, and in some respects merits emphatic condemnation." This subject is discussed fully in a separate section of the Report, which contains the opinion and proposals of the Committee, and which they respectfully request may be submitted to the Lord President of the Council for transmission to the General Medical Council. They trust that the Council will take this Report into their early and favourable consideration. The Council is no doubt fully aware that one of the major difficulties of the situation is that the cases of midwifery available for the advancement of medical education are at present allotted to the educational advantage of pupil midwives rather than medical students. Yet only 20-25 per cent. of the 60,000 trained midwives on the Roll of the Central Midwives Board actually practise midwifery, whereas the medical practitioner may at any moment be charged with the responsibility of practising midwifery; and in regard to the 60 per cent. of cases conducted by midwives, the confinements to which he is called will usually be abnormal. The imperative necessity of an adequate practical training of the students thus become obvious. We submit their claim has priority over that of the pupil midwives, the majority of whom take their course without any intention of practising midwifery. What is urgently needed is a reallocation of cases for educational purposes and an extension of the number available.

II.—THE SUPERVISION OF PREGNANCY.

205. For many years it has been the custom for pregnant women applying for admission to a lying-in institution to furnish particulars of their health, and occasionally to be examined some weeks before the prospective date of confinement. More than forty years ago attention was first prominently directed in this country to intra-uterine death, and historically the movement in favour of *ante-natal supervision* sprang from the desire to reduce abortions and stillbirths. In 1915 the notification of stillbirths was established by law,* and the necessity of preventive care of the expectant mother came to be more generally recognised. Ballantyne and others have shown that adequate supervision of this kind does, in fact, substantially reduce the occurrence of stillbirths, and the early information gained as to morbid conditions conduces to normal pregnancy and safe delivery. It is now well recognised that systematic ante-natal observation furnishes important data as to the probable course of pregnancy and labour. Such measures as enquiry into the previous obstetric history, systematic examination of urine, pelvic measurement, careful estimation of disproportion between child and pelvis, and abdominal palpation to determine presentation enable many dangers to be foreseen and forestalled. Opportunity is also afforded for the early recognition and treatment of such morbid conditions as toxæmia and venereal disease; moreover, the general hygiene of the expectant mother can be safeguarded, and she can be prepared for childbirth and nursing.

Ante-natal supervision is now recognised as an essential part of the care of pregnant women, and yet from a study of the maternal death returns it is seen that there are still many women who die in childbirth as a direct result of its omission.

While emphasising the extreme importance of ante-natal examinations, the Committee have found evidence of a certain amount of inefficient work which has passed under the guise of "ante-natal care." They consider that effective ante-natal care requires as much experience, skill and diligence as operative midwifery itself, and that every effort should be made to secure proper medical supervision by competent medical practitioners in close touch with practical obstetric work. Not only have the Committee found evidence of neglect in ante-natal diagnosis, but also to a great extent in ante-natal treatment. In many instances where some abnormality has been discovered during pregnancy the treatment has left much to be desired, and this failure to treat a patient has largely been due to lack of facilities for ante-natal treatment.

The Committee have no hesitation in saying that every pregnant woman should have the advantage of effective ante-natal supervision, and in every area necessary arrangements should be made to this end. Such arrangements should include the education and encouragement of the mother to make use of the facilities provided, to

* The records are published in the Annual Reports of the Chief Medical Officer of the Ministry of Health *On the State of the Public Health.*

ensure free choice of doctor and midwife where practicable, and to provide for a thorough and efficient system of "following-up" and treatment of any unfavourable pre-natal conditions. At present facilities are provided at 900 ante-natal clinics, but we are strongly of opinion that the ante-natal supervision should be carried out wherever possible by the medical practitioner who will be responsible for the delivery of the child at labour. At present 60 per cent. of confinements are conducted by midwives, but it is hoped by the Committee that in the near future it will be the rule for a doctor as well as a midwife to be associated with every case of childbirth.

III.—IMPROVEMENT IN MEDICAL PRACTICE.

206. Whilst the Committee recognise under what a serious handicap the general medical practitioner often works in obstetric cases, they have had evidence of a need for increased vigilance and attention in not a few cases, especially in regard to particular points. For instance, the Committee have been impressed by the widespread use of diluted lysol or other antiseptics in solution lacking potency as a bactericide; by the fact that in nearly a third of the cases classed as errors of judgment on the part of the doctor the mistake made was the premature application of the forceps for delivery; by the comparative rarity with which intravenous or subcutaneous injection of saline, or even its introduction per rectum, was given in ante-partum or post-partum hæmorrhage; and by the absence of full and accurate clinical records made at the time of childbirth. In relation to serious complications and accidents of labour, whether or not they might have been foreseen and averted by ante-natal care, the Committee have evidence of need for a higher standard of knowledge and skill on the part of the medical practitioner on the spot as well as for the provision of consultant services and of an increased number of available hospital beds. The need for specialist help in emergency, for trained and competent nursing, and for hospital treatment seems to be less generally recognised for midwifery than it is for surgical operations. Surprisingly good results are often obtained in untoward circumstances, but not infrequently the doctor attempts, or is driven to attempt, the impossible, and the case ends in death. The Committee are therefore satisfied that there is need for an improved practice of midwifery. They also consider that it would be advantageous for enquiries into maternal death to become a regular practice on the part of the Local Supervising Authority.

IV.—THE CO-ORDINATION OF MATERNITY SERVICES.

207. The Committee wish to express their full appreciation of the immense progress which has been made in recent years in the development of a National Maternity Service—the work under the Midwives Acts, the establishment of ante-natal, maternal and infant welfare clinics, the provision of maternity homes and hospitals, the institution of maternity benefit, the increased availability of

nurses, etc.—but they consider that there is further need for the co-ordination of these services in every health area concerned and their extension to enlist the co-operation of the general practitioner. They would particularly mention the need for a wider and more thorough practice of preventive medicine in relation to midwifery, ante-natal supervision, the conduct of labour and the puerperium, post-natal supervision and the diagnosis and treatment of venereal disease; the necessity for making a trained midwife available for every woman in childbirth and a medical practitioner for every difficult or complicated labour; and the provision of specialist consultant service and more hospital beds for exceptional cases. It is not within the province of the Committee to propose the administrative or financial arrangements by which these desiderata are to be furnished by the State or the Local Authority. But they wish to state explicitly their view that at present the maternity services are not yielding their potential value and are not proving a solution of the problem of maternal mortality, because of the lack of co-ordinated effort to secure the conditions named above, which the Committee are satisfied, from a medical point of view, are essential to success. For convenience, and to give a practical trend to their recommendations in this behalf, the Committee have formulated their proposals, on this part of the subject, in the chapter of their Report dealing with a National Maternity Service. The essential services to be provided may be summed up as follows:—

- (1) The provision in every case of the services of a qualified midwife to act either as midwife or as maternity nurse.
- (2) The provision of a doctor to carry out ante-natal and post-natal examination in every case, and to attend during pregnancy, labour and the puerperium, as may prove necessary, all cases showing any abnormality.
- (3) The provision of a consultant, when desired by the doctor in attendance, during pregnancy, labour and the puerperium.
- (4) The provision of hospital beds for such cases as need institutional care.
- (5) The provision of certain ancillary services (*e.g.*, transport, sterilised equipment, laboratory facilities).

Such facilities cannot prove effective unless they are both used and correlated. By means of the co-ordination and extension of such arrangements on the principles laid down in the present Report the Committee are convinced that many preventable deaths can be, in fact, prevented.

203. We desire, in conclusion, unanimously to record our warm appreciation of the devoted services of Dr. Jane H. Turnbull, who has kindly acted as our Secretary. The Committee consider themselves exceptionally fortunate in having had as Secretary one who is herself a skilled obstetrician, and who has brought to her task both clinical and administrative experience. In addition, we are grateful for the patience and good nature with which Dr. Turnbull has met our very numerous demands upon her willing and unstinted service.

Finally, this Report would not be complete without a cordial expression of our appreciation of the co-operation and goodwill of many medical practitioners in an investigation which, without their aid, would have been impossible.

(Signed) GEORGE NEWMAN, Chairman.

F. J. BROWNE.

JANET M. CAMPBELL.

E. CASSIE.

LEONARD COLEBROOK.

ARCHIBALD DONALD.

CHAS. E. S. FLEMMING.

WALTER M. FLETCHER.

H. KERR.

W. H. F. OXLEY.

MILES H. PHILLIPS.

C. E. TANGYE.

O. L. V. S. DE WESSELOW.

JANE H. TURNBULL, *Secretary.*

June, 1930.

LIST OF APPENDICES.

- A. Royal College of Physicians: Report on Anaesthetics in Confinements.
 - B. British College of Obstetricians and Gynaecologists: Memorandum on the Use of Anaesthetics in Confinements.
 - C. British Medical Association: Report of Sub-Committee on the Place of Anaesthetics and Analgesics in Midwifery.
 - D. Memorandum: The Sterilisation of the Hands, by Leonard Colebrook, M.B., B.S.
 - E. Memorandum: The Need for Bacteriological Services in the Control of Puerperal Infections, by Leonard Colebrook, M.B., B.S., and F. Griffith, M.B., Ch.B.
 - F. Memorandum on Ante-natal Clinics: Their Conduct and Scope, drawn up by the Maternal Mortality Committee and issued by the Ministry of Health.
 - G. Copy of Death Enquiry Form of the Maternal Mortality Committee, with Explanatory Note.
 - H. List of Medical Men who attended Sub-Committees by invitation of the Committee.
 - J. List of Bodies and Persons who submitted statements or gave evidence before the Committee.
 - K. List of Papers submitted to the Committee.
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APPENDIX A.

ROYAL COLLEGE OF PHYSICIANS OF LONDON.

Report on Anaesthetics in Confinements.

The Royal College of Physicians has been asked by the Ministry of Health to give a pronouncement on the advisability and place in labour of sedatives, analgesics, and anaesthetics. While whole-heartedly agreeing that every effort should be made to insure relief from pain to any woman labouring with child, the College finds it necessary to point out that both the mother and child may be exposed to grave risks by the indiscriminate use of analgesics and anaesthetics. These risks and certain recommendations as to how they may be minimised are dealt with in this report.

The drugs used for the relief of pain in labour may be divided into 3 groups:—

1. *Sedatives.*
2. *Analgesics.*
3. *Anaesthetics.*

The action of each group is especially adapted for the different stages of labour—and each has its own advantages and dangers.

1. *Sedatives.*

Only three need be referred to, the Bromides, Chloral and Tincture of Opium.

The administration of these drugs in full doses is permissible in the early stages of labour. The dangers associated with their administration are not specially modified or increased by pregnancy and labour.

Precautions.—Total doses larger than 30 grains of Chloral Hydrate, 60 grains of a Bromide, or one drachm of Tincture of Opium may not be given by any midwife without medical supervision.

2. *Analgesics.*

The more important drugs in this group are Morphine, Hyoscine and Omnopon.

The administration of these drugs must be limited to the first stage of labour. *They are scheduled under the Dangerous Drugs Act.* The danger to the mother is not increased by pregnancy or labour and the precautions are therefore the same as in general medical or surgical cases. The foetus, however, is often affected, and the probabilities of a child being born in a state of profound apnoea are greatly increased if an injection of these drugs is given within 2 hours of its birth.

Precaution with regard to labour.—These drugs should never be given by a midwife or maternity nurse except on the direct personal instruction of a fully qualified practitioner, and any subsequent doses must be separately ordered by such medical practitioner.

3. *Anaesthetics.*

Anaesthetics are used for two reasons in obstetric practice.

- i. Full surgical anaesthesia for various obstetric operations, *e.g.*, The application of forceps. Version. Caesarean section.

It is obvious that full surgical anaesthesia can only be safely induced by a specially trained anaesthetist or medical practitioner. Detailed criticism on the various anaesthetics and their method of administration in labour is not within the reference from the Ministry of Health, but further information can be obtained by referring to the Proceedings of the Royal

Society of Medicine, Volume XXI (1928), Section of Anaesthetics, which contains a report of a discussion on the subject by a joint meeting of the Anaesthetic and Obstetric Sections.

ii. Solely for the relief of pain in natural labour.

Except under exceptional circumstances in multiparae, it is not permissible to give an anaesthetic solely for the relief of pain in labour, until the second stage has definitely commenced. For practical purposes in general practice chloroform is the only anaesthetic which can be used for the relief of pain in a natural labour. In hospitals and nursing homes other anaesthetics such as gas and oxygen, ether or paraldehyde per rectum, give good results, but the cumbersome apparatus necessary for the former and the site of administration of the latter render their use practically impossible in a patient's own house.

The method of administering chloroform for the relief of pain in natural labour was devised by Sir James Simpson over 80 years ago. It is called "the intermittent method." The technique is a very special one and can only be acquired by practical instruction, but the actual administration can be made by an unskilled person under the direction of someone who has had expert training. If given in this way the administration of chloroform is quite safe for a limited time during child-birth; but when that limited time has been passed a special danger immediately threatens. This danger is a uterine inertia which is due to the action of chloroform on the uterine muscle. The moment chloroform begins to produce an inert uterine muscle the risks of a delayed second and third stage of labour and of postpartum haemorrhage are increased. Both these complications are fruitful sources of maternal morbidity and mortality.

At present anaesthetics can be administered only under the direct supervision of doctors, and before departing from this practice careful consideration will have to be given to the matter. Stringent rules would have to be drawn up before allowing midwives or maternity nurses to give anaesthetics for the relief of pain in labour on their own responsibility. In order that the administration of drugs for the relief of pain may safely be offered to women who so desire it the following suggestions are submitted:—

For the Present Time.

1. In all lying-in hospitals (including the obstetric beds in poor law hospitals) special arrangements should be made for such administration.

Such arrangements would include:—

- (a) A resident and visiting staff capable of carrying out the increased amount of work.
 - (b) Special courses of instruction.
2. All medical students and midwives should receive instruction in the intermittent method of administering chloroform in normal labour.

For the Future.

3. Some responsible body such as the Central Midwives Board should be asked to draw up the necessary regulations as to the increased training for the midwives and stringent rules as to how far a midwife could give chloroform on her own responsibility. Such rules would require very careful consideration, but the first and most important one would of necessity be one which placed a very definite limit on the length of time a midwife might administer an anaesthetic without informing or sending for a doctor.

Whether administered by doctors or midwives it is clear that there are limitations to the wide and general use of sedatives, analgesics and anaesthetics for the relief of pain in natural labour. As already explained all drugs of this kind interfere in some degree with the natural forces. If however they are administered in hospital under proper medical supervision the contra-indications are negligible.

The incidence of *low* forceps deliveries would certainly be increased, but the advantages gained by the educating of doctors and medical students in the application of forceps and in the intermittent method of administering chloroform would be of service to the community.

It is possible that a time may come when the obstetric service of the country may be more in the hands of midwives than it is at present—more confinements may take place in hospitals and fewer doctors may actually be present at confinements, although their ante-natal supervision will be largely increased.

When that time comes it may be that midwives will possess such a measure of skill and experience that they may be trusted with the responsibility of administering chloroform in labour.

At present such a practice would be disastrous.

(Signed) RAYMOND CRAWFURD,
Registrar.

Jan. 30, 1930.

APPENDIX B.

BRITISH COLLEGE OF OBSTETRICIANS AND GYNÆCOLOGISTS.

Memorandum on the Use of Anaesthetics in Confinements.

The Ministry of Health has invited the College to furnish a Report on Anaesthetics and Sedative Drugs and their administration during parturition. The Council of the College therefore submits the following Memorandum.

PART I.

ANAESTHETICS AND THE METHODS OF ADMINISTRATION.

These fall under five subdivisions:

- (1) General inhalation anaesthesia.
- (2) General oral and subdermal narcotics. ...
- (3) Spinal anaesthesia.
- (4) Rectal anaesthesia.
- (5) Local anaesthesia.

(1) The commoner chemical materials used for general inhalation anaesthesia in Great Britain are:

- (a) Chloroform.
- (b) Ether.
- (c) A.C.E.
- (d) Nitrous oxide and oxygen.

(a) *Chloroform* has been very widely—almost exclusively—used by general medical practitioners. This substance has the advantage in clinical obstetrical practice that it is not unpleasant, and that the method of administration is easy for an experienced practitioner. In an ordinary uncomplicated case it is unnecessary for the doctor to place the patient deeply under its influence; in fact, the patient is rarely more than semi-conscious, in which circumstances the uterine contractions are not usually greatly diminished, yet the patient, although she may cry out with each recurring "pain," is quite oblivious of all that happens, and has no memory of the events when "all is over." Moreover, in obstetrical practice in such circumstances chloroform has proved to be singularly safe. Its safety in labour lies mainly in the fact that only the lightest state of anaesthesia—so called obstetrical anaesthesia—is required, and that the blood-pressure is raised during parturition.

Should the patient suffer from any form of toxæmia, with associated acidosis, the danger to the patient is considerably enhanced.

(b) *Ether*, especially ethyl-ether, is more unpleasant to inhale than chloroform, and the patient may be more difficult to manage; but when skilfully given by the open method it is very safe—far more safe than chloroform for deep anaesthesia.

In obstetrical practice the chief difficulty in connection with the use of ether is that a condition of light anaesthesia is more difficult to obtain and maintain than is the case with chloroform. Nevertheless, owing to the safety of the open method the patient may be fully anaesthetised at first and then be allowed to drift back to semi-consciousness, a state not then so hard to maintain if close attention be paid to her. This method necessarily, therefore, requires the undivided attention of the administrator.

It is possible to train any fully-certificated nurse in the administration of ether by this method. In other countries nurses are largely employed in the administration of "open ether."

One great disadvantage of ether is that it is highly inflammable; consequently great care is required when it is administered in a small room with an open fire.

(c) *A.C.E.*, which is a mixture of alcohol, chloroform and ether, was probably introduced to lessen the danger of chloroform, the somewhat slow effect and unpleasant taste of ether, and to combine the advantages of each. Nevertheless, the *A.C.E.* mixture is not much utilised in the present day.

Silk,* however, has shown that a mixture consisting of 3 per cent. of chloroform with ether is safe, and possesses certain advantages over the ordinary "open ether" method.

We think that further investigation of the use of Silk's mixture in labour is required before it can be definitely recommended.

(d) *Nitrous Oxide and Oxygen*. This mode of anaesthesia is particularly safe and unharmed even in the presence of toxæmia. The effects pass off almost immediately. Skilled administration and a somewhat cumbersome apparatus are required. It would be undesirable for nurses to attempt this form of administration in obstetrical work, and, indeed, it is not practicable in the absence of an expert.

(2) The chief disadvantage that appertains to all forms of *oral* and *subdermal* narcotics is that a continued state of unalterable oblivion is obtained. The "in-and-out" type of anaesthesia is not possible. Further, it is necessary to employ powerful drugs such as morphia and hyoscine, which cannot safely be used by a nurse on her own initiative. Indeed, it may be said that, apart from the production of morphine-hyoscine narcosis, these and other drugs such as chloral, are used principally in small doses to secure temporary abatement only of labour to enable the mother to obtain respite.

Morphine-hyoscine narcosis is difficult to apply in ordinary maternity work owing to the close attention necessary.

(3) *Spinal anaesthesia* has been widely used in obstetrical clinics during the performance of Caesarean section, and is of undoubted value where the operation is performed in toxæmic, "suspect" and cardiac cases.

Owing to the technical skill required for the introduction of the drug used, and the possibility of spasm of the circular muscle-fibres†, spinal anaesthesia is not at present employed in normal parturition.

(4) *Rectal anaesthesia* in labour has been practised and advocated in America, but not, we think, in this country; consequently we are unable to express an opinion about it.

(5) *Local anaesthesia* by the injection of novocaine into the lateral perineal regions to "block" the perineal nerves has been largely practised in America. This procedure has the advantage of rendering the parts insensitive during the later phases of the second stage of labour, and of abolishing rigidity of the muscles.

A similar effect has been noted in regard to the "rigid cervix" when novocaine is injected into the bases of the broad ligaments close to the cervix.

These methods cannot, of course, be practised by a nurse under the present method of training. In any case, the decision to utilise them would inevitably be dependent on the judgment of the doctor.

PART II.

It is, no doubt, undesirable that any woman should suffer the pangs of childbirth when the pain can advantageously, safely and surely, be alleviated by scientific methods.

Nevertheless, the fact must be borne in mind that if anaesthesia is to be administered solely on the demand of the patient or her relations (and all doctors know how insistent may be such demands), much harm may be done to the mother and her child.

* Brit. Med. Journ., 1919, i. 635.

† Brit. Med. Journ., 1923, ii, 406.

We need not be concerned with the production of deep surgical anaesthesia, for in securing this the method and drug employed must always depend on the judgment of the surgeon and anaesthetist, and in certain cases (as illustrated in the use of spinal anaesthesia in heart disease) on that of the physician.

All anaesthetics administered during labour, except those like novocaine, which are injected locally, interfere to some extent with the uterine contractions, either by inhibition of all the muscular contractions, or by inhibiting some and thus allowing others to act excessively. Drugs such as infundibulin can counteract this effect, but great experience and judgment are required in their use.

We are called upon, we imagine, to advise chiefly as to the manner and material which, while effective, is safest and most readily applicable to the ordinary patient in uncomplicated or very slightly complicated labour conducted in her own home by the doctor in attendance or by the maternity nurse, and to state whether the nurse should administer the anaesthetic in the presence of a doctor or in his absence.

While we believe that whenever a deep degree of anaesthesia is required, as for internal version, a doctor who can devote himself to the administration of the anaesthetic should be present, we recognise that light anaesthesia is capable of being maintained by a properly instructed nurse if she be *fully certificated*, provided a doctor is present to decide that anaesthesia is desirable.

It would be a simple matter for a fully certificated nurse to receive instruction in the administration of light anaesthesia during her six months' training in an Obstetrical Hospital or Department.

We do not think it right or proper for a midwife possessing only the C.M.B. certificate to undertake such a duty, for she has neither the knowledge nor the everyday experience of anaesthesia and its results in a variety of circumstances such as falls to the lot of a fully certificated nurse.

If the scheme for the eventual employment of fully certificated nurses which the College of Obstetricians and Gynaecologists is drafting for the consideration of the Minister of Health be adopted, this question would to some extent be solved.

We would, therefore, recommend :

- (1) *Deep* inhalation anaesthesia should be induced only by a qualified medical practitioner.
- (2) *Light* inhalation anaesthesia (Obstetrical anaesthesia) can safely be induced by a fully certificated nurse provided a doctor is present throughout the whole period of administration.
- (3) All other methods of anaesthesia should be administered by a qualified practitioner only.
- (4) Narcotics should not be given by a nurse, except on the instructions of a doctor, unless there be urgent necessity.

Signed on behalf of the Council of the
British College of Obstetricians and
Gynaecologists,

W. BLAIR BELL,
President.

February, 1930.

APPENDIX C.

BRITISH MEDICAL ASSOCIATION.

Report of Special Committee upon the Place of Anaesthetics and Analgesics in Midwifery.

I.—PRELIMINARY.

1. As a preliminary to making a pronouncement upon the place of anaesthetics and analgesics in midwifery, the British Medical Association wishes to place on record its whole-hearted belief that every effort to ensure relief from pain and suffering to women in childbirth should be made, provided the mother and child are not thereby exposed to undue risks. Any limitation in the use of anaesthetics or analgesics is only warranted by disadvantages or dangers in their use.

II.—THE USE OF ANAESTHETICS IN LABOUR.

2. In difficult labour, where full anaesthesia is necessary, the anaesthetic should be administered wherever possible by a second doctor; it is always advisable that the anaesthetic be administered by a second practitioner, both for the greater safety of the patient under the anaesthetic and the less risk of sepsis when the doctor delivering does not need to handle the anaesthetic.

3. The question remains how far in normal labour anaesthetics can be given purely for relief of pain without increasing the danger to mother or child. Unfortunately, none of the anaesthetics and analgesics to-day available for midwifery are without danger, and consequently the British Medical Association finds itself unable to recommend that it is wise to provide for anaesthetics in all cases of labour even if the question of cost were entirely removed.

Chloroform.

4. The common form of anaesthetic used in midwifery in this country is chloroform or a mixture containing chloroform. Chloroform given during labour diminishes the strength and frequency of the uterine contractions and the semi-voluntary bearing down efforts of the mother; it therefore prolongs labour and increases the frequency of the use of forceps with the risks that this entails.

5. If this anaesthetic is given in the first, or even in the second, stage it will, in most cases, have to be continued. Prolonged chloroform inhalation causes changes in the liver, which lead to delayed poisoning within the next few days, sometimes with fatal results. This is much more pronounced if acidosis is present. It is probable that some deaths ascribed to obstetric shock or toxæmia are in reality due to delayed chloroform poisoning.

6. With a patient under chloroform the natural separation of the placenta takes longer, and a tendency to relaxation of the uterus is present; therefore, the risk of hæmorrhage and the necessity for manual extraction of the placenta are increased. This danger is, however, diminished by skilled use of pituitary extract.

7. Chloroform may be used to produce a light anaesthesia in which the patient is able to assist the second stage by muscular effort, but is not conscious afterwards of any experience of pain. This is not possible in all cases. In some the patient in the semi-conscious condition is so difficult to control that she must either be allowed to come round or deeper anaesthesia must be produced and labour completed with forceps. But in those very numerous cases in which it can be carried out it is a very humane and a safe proceeding. A patient can be kept in this state by the administration of very small quantities of chloroform. The delay and the very definitely increased risk of postpartum hæmorrhage have both been largely removed since the introduction of pituitary extract.

8. The administration of an anaesthetic requires skilled judgment and medical knowledge. This applies as much to light as to full anaesthesia.

9. In addition to their use in relieving pain anaesthetics are of value in preventing shock.

Aether.

10. In cases where chloroform cannot be administered with safety, aether may be given and the dangers mentioned in paragraph 5 would be thereby diminished; aether is, however, unsuitable for administration by the intermittent method, and its inflammable nature leads to further risks in domiciliary practice.

Gas and Oxygen.

11. Although gas and oxygen is recognised as a very safe means of producing anaesthesia in midwifery, it needs cumbersome apparatus and special knowledge, and its use is therefore confined to institutional practice and to cases in which the services of a specialist anaesthetist are available.

Anaesthesia by Rectal Administration.

12. Various methods of producing anaesthesia by rectal administration have been recently introduced, but their safe use and exact value have not yet been ascertained.

III.—THE USE OF ANALGESICS IN LABOUR.

Combined Use of Morphine and Hyoscine.

13. The use of morphine and hyoscine to produce what is known as " twilight sleep " is of value, but its administration requires special experience, and reports as to its safety vary.

Opium and its Derivatives.

14. For the relief of the pains of a slow and ineffective first stage (especially in a primipara) the use of opium or one of its derivatives is most valuable. It regularises the pains and soothes the mother and so hastens delivery by some hours.

15. Where the uterus is in a condition of secondary inertia opium rests the uterus and sends the mother to sleep, during which time the os slowly dilates without pain, and labour quickly finishes when the mother awakes. Obviously the drug should not be used until any possible cause of obstruction has been diagnosed.

16. Another danger is that opium administered to the mother in effective cases within a short time of delivery adds to the difficulties of exciting the respiratory centre in the new-born babe, and may result in a still-born child.

17. Many cases of somewhat difficult breech delivery can be better treated if the woman is not anaesthetised, as the bearing down efforts of the mother help the fundal pressure of the midwife or her assistant. As these cases are frequently tedious, the use of analgesics would diminish the risk of premature interference. If this practice were followed, the probability is that the high foetal mortality in such cases would be much reduced.

Chloral Hydrate.

18. Chloral hydrate is often used with advantage where the first stage is prolonged.

IV.—THE USE BY MIDWIVES OF ANAESTHETICS, ANALGESICS AND SEDATIVES.

19. The British Medical Association is of opinion that the midwife should not administer anaesthetics, opium or its derivatives, pituitary extract, or

other dangerous drugs, except in so far as she may be acting under, or carrying out the instructions of a medical practitioner. It is of this opinion:—

- (i) with regard to *anaesthetics*, on account of the well-known dangers attendant upon their administration;
- (ii) with regard to *opium and its derivatives*, on account of the danger of unrecognised obstruction and the risk to the life of the child; and
- (iii) with regard to *pituitary extract*, on account of the risk of ruptured uterus and the danger to the unborn child.

(Sgd.) CHRISTINE M. MURRELL,
*Chairman of the Committee on
Anaesthetics and Analgesics in
Midwifery.*

(Sgd.) ALFRED COX,
Medical Secretary.

Medical Department,
British Medical Association,
British Medical Association House,
Tavistock Square,
London, W.C. 1.

27th March, 1930.

APPENDIX D.

Memorandum on the Sterilisation of the Hands. By Leonard Colebrook, M.B., B.S.

Introductory.

A search for published evidence as to the relative efficacy of treatment by lysol or perchloride of mercury for the sterilisation of the hands has failed of its purpose; but it has enabled me to make a general survey of the experimental work done in this field. Most of it was published in German journals between 1890 and 1910.

The experiments reported have differed chiefly in two respects, viz. :—

(a) As to whether the hands were artificially infected or not before treatment with antiseptics. When they were so infected it was usually with a microbe easily detectable in cultures, such as *B coli* or *B prodigiosus*. Although much of the work was done with a view to the prevention of puerperal infection, recognition of *Streptococcus pyogenes* as the most important cause of these infections was not general at that time and attention was not, therefore, directed particularly to the elimination of that microbe from the hands.

(b) As to the procedures employed for determining the number of viable microbes left on the hands after treatment by antiseptics. Some investigators have been content with simply rubbing the finger points on the surface of solid nutrient medium; others have dipped the finger points in melted medium which was afterwards allowed to set; others again have swabbed or scraped the fingers in order to liberate any microbes in the depths of the skin, subsequently making cultures in fluid medium or on the surface of solid medium from the swabbings or scrapings.

These differences of procedure are of considerable importance in judging of the results obtained by different investigators.

Hands which appear to be sterile if tested merely by rubbing the pulps of the finger tips on solid medium will often yield a great number of colonies if a more stringent test is applied, for example, swabbing the whole of the finger skin, including the nail bed and sulcus.

Experiments with Alcohol and Alcoholic Solutions.

Since about 1895 many of the German workers have followed the lead of the late Prof. Ahlfeld (an obstetrician) (1) in advocating alcohol in preference to perchloride of mercury and lysol which, they assert, had proved unsatisfactory. Schumburg's work (2) in particular should be consulted in this connexion. He showed that treatment of the hands with alcohol (70-95%) does reduce very considerably the number of microbes which can be grown from them, but seldom, if ever, makes them completely sterile. Further that the removal of microbes was the more effective if the hands had not been previously washed in hot water.

Ahlfeld contested this latter statement but did not bring forward satisfactory evidence against it.

Schumburg also showed that little if any advantage was gained by soaking the hands, after they had been treated by alcohol, in stronger antiseptics such as perchloride of mercury (Furbringer's method (3)), or lysol.

There has been much discussion as to how the partial sterilising effect of alcohol is achieved. Some have held that it is a direct bactericidal process

(Ahlfeld), others that the microbes become fixed to the skin in consequence of the fat-solvent and dehydrating action of the alcohol (Stahlschmidt (4)).

Leedham Green (5) and other writers have pointed out that alcohol, when frequently applied to the hands, defeats its own purpose because it makes the skin rough and cracked, and in this condition the difficulty of making the surface sterile is very much increased.

Experiments with Iodine.

A useful account of these is given by Seedorff (1920 (6)). He was concerned more with the sterilisation of skin before surgical operations than with the skin of the hands. Although he quotes, and apparently confirms, the observation of Claudius (7) that iodine is more effective in watery solution of potassium iodide than in alcoholic solutions, Seedorff advises the latter, particularly solutions in propyl alcohol. He does not, however, claim that absolute sterility of the skin can be obtained by this or any other agent with regularity. To get the best results he advises preliminary mechanical cleansing with soap and water, as this removes the major part of the bacteria fortuitously planted upon the hands, including the spores.

By the study of frozen sections of skin removed at operation he was able to show that one hour after a second painting with 5% iodine (whatever the solvent) penetration had occurred only half-way through the stratum corneum: ten minutes after a second painting with a 10% solution it had reached to the boundary between the stratum corneum and the stratum germinativum (Malpighian layer).

But in view of the irritant effect of solutions of this strength on certain skins their use for routine obstetric work would seem to be out of the question.

Experiments with Hypochlorites and Chloramine T (Para toluene sodium sulpho-chloramide).

Inasmuch as the hypochlorites probably act (Dakin) by virtue of the formation of chloramines when in contact with protein substances, or protein degradation products, these two agents may be considered together.

The chief papers met with are those of Conover and Laird (8) who advocate the use of Eupad (boric acid and chlorinated lime, 0.15% of each in water); of Monziols (9), who used a mixture of boric acid with calcium chloride and sodium carbonate, made into a paste with a few drops of water; and of Bergin (10), who recommends "Chloramine-Heyden" (0.25 to 0.5%). All these authors claim that the hands can frequently be rendered sterile by the procedure they employed, but the bacteriological data are scanty. In order to get rid of the objectionable smell remaining on the hands they recommend the use of sodium thiosulphate.

Experiments with Formalin.

A. A. Babsky (11) carried out an extensive series of observation—on 227 subjects—with formalin solutions of different strength in glycerine. Details of his procedures are not very full, but he states that the hands were swabbed for the sterility test, and the swabs afterwards soaked in water in order to avoid any transfer of formalin to his culture medium. He obtained complete sterility in 50-70% of his tests after treatment of hands (duration not stated) with 3% formalin. Four per cent. and upwards was found to be irritant to the skin.

Experiments with Permanganate of Potash.

The only paper met with is that of Grimsdale (12), of Liverpool, who adopted the method of Schatz. He claimed to have completely sterilised the hands by washing (7 minutes) followed by saturated permanganate of potash till the skin was stained brown, then a solution of oxalic acid to decolorise, and finally lime water to neutralise the acid.

Summary of Impressions Gained by a Survey of the Literature.

1. Notwithstanding the claims of some authors it is probably impossible to sterilise completely the skin of the hands by any chemical treatment which does not injure the skin if frequently employed. The nail bed, nail sulcus and the backs of the fingers seem to be the most difficult parts to free from microbes.

2. Mechanical cleansing with soap and water removes a large part of the bacteria, including spores, which are fortuitously implanted upon the hands from time to time; but the residual flora (staphylococci, sarcinae and diphtheroid bacilli) is often not reduced in numbers—indeed it may be increased—by washing in hot water.

3. Although the number of viable microbes on the hands can be considerably reduced by treatment with alcohol, frequent repetition of that treatment is undesirable because it tends to make the skin rough and cracked.

4. There is not very much evidence as to the efficacy, or otherwise, of treatment by perchloride of mercury or of lysol as commonly employed in this country.

My Own Experiments.

The result of my survey of the literature seemed to show that there was need for further data before conclusions could be formulated with reference to obstetric practice. The problem of puerperal fever has been narrowed down to a large extent in recent years to a question of infection by streptococcus pyogenes, and the elimination of that microbe from the hands of those in attendance upon midwifery cases should therefore be kept prominently in view. The bacteriological investigations which are here described deal with:

(1) the occurrence of streptococcus pyogenes on the hands of maternity and surgical nurses and of medical men,

(2) the spontaneous disappearance of streptococcus pyogenes—and of other microbes—from the hands of normal individuals artificially infected,

(3) the effect of washing alone upon the microbic flora of hands so infected,

(4) the effect of treating the hands with perchloride of mercury and with lysol upon streptococci and upon the normal flora of the hands,

(5) the effect of other procedures which have been advocated for sterilisation of the hands,

(6) the chemical sterilisation of rubber gloves on the hands.

The Occurrence of Streptococcus Pyogenes on the Hands of Nurses, Medical Men and Others.

The fingers of 26 nurses employed in maternity and surgical work, and of 19 medical men and others employed in laboratory work, were swabbed with sterile broth and cultivations made in poured blood-agar, and on the surface of blood-agar plates.

In no instance was streptococcus pyogenes isolated. Staphylococcus albus was the most common organism, those associated with it being sarcina, yellow staphylococci, diphtheroid bacilli and diverse air-borne bacillary and mycelial types.

Although streptococcus pyogenes was not found in this series and has never, so far as I am aware, been isolated from normal hands, the possibility ought to be kept in mind that on hands which are chapped or slightly affected with chilblains or eczema this microbe might become temporarily a constituent of the habitual flora.

No opportunity to investigate this has occurred.

*The Spontaneous Disappearance of Streptococcus Pyogenes—and of Other
Microbes—from the Hands.**

In the course of experiments with hands artificially infected with bacterial cultures it was sometimes observed that the number of these bacteria recovered from swabbings was surprisingly small—so small as to suggest that they were being rapidly killed on the skin.

To put this to the test several fingers of a normal hand were infected with broth cultures of various microbes. As soon as the hands had dried—and at intervals later—one finger was thoroughly swabbed with sterile broth. (A finger provided a convenient unit in all these experiments.) Bacterial enumerations of the several samples of broth were made by appropriate dilution and replanting in melted agar or on the surface of a solid nutrient medium. By simple calculation from the number of colonies resulting we arrived at the total number of microbes washed off each finger.

Typical results of such experiments were as follows:—

Streptococcus pyogenes.

Exp. 1. One finger (R.H.)	3 minutes	after infection	gave	30,000,000 colonies	
					S. pyogenes.
2nd "	1 hour	" "	" "	1,722,000	" "
3rd "	2 hours	" "	" "	7,000	" "
Exp. 2. One finger (L.C.)	5 minutes	after infection	gave	2,200,000 colonies	
					S. pyogenes.
2nd "	30 "	" "	" "	520,000	" "
3rd "	1 hour	" "	" "	280,000	" "
4th "	2 hours	" "	" "	7,000	" "
Exp. 3. One finger (C.E.D.)	15 minutes	after infection	gave	1,900,000 colonies	
					S. pyogenes.
" "	1 hour	" "	" "	1,300,000	" "
" "	2 hours	" "	" "	200,000	" "
" "	3 hours	" "	" "	8,000	" "

On several occasions the hands thus infected with *S. pyogenes* were swabbed on the day following the experiment—but in no instance was this microbe cultivated. (The hands had, of course, been washed several times in the interval.)

Bacillus proteus.

Exp. 4. One finger (L.C.)	2 minutes	after infection	gave	525,000 colonies	
					B proteus.
2nd "	15 "	" "	" "	7,000	" "

Friedlander's bacillus.

Exp. 5. One finger (L.C.)	2 minutes	after infection	gave	24,000,000 colonies	
					Friedlander's bacillus.
2nd "	10 "	" "	" "	2,700,000	" "
3rd "	60 "	" "	" "	84,000	" "

Bacillus coli.

Exp. 6. One finger (L.C.)	10 minutes	after infection	gave	630,000 colonies.	
" "	35 "	" "	" "	98,000	" "
" "	70 "	" "	" "	7,000	" "
" "	150 "	" "	" "	700	" "

* After these experiments were finished and incorporated in this Report my attention was called to similar observations published by Charlotte Singer and Lloyd Arnold in the Proceedings Soc. Exp. Biol. and Med., Vol. 27, page 364. My own experiments had been first described (verbally) to the Pathological Section of the Royal Society of Medicine at a meeting held at St. Mary's Hospital, London, on Nov. 5, 1929.

These results show that several different microbic species are rapidly killed on the skin of the hands. The chances of transfer of pathogenic organisms (including haemolytic streptococci) from patient to patient on the hands of medical men and nurses must be greatly reduced by the operation of this bactericidal mechanism, quite apart from washing and antiseptic procedures.

It is not proposed to deal at any length here with the explanation of this bactericidal effect exerted on the skin. Three possible hypotheses suggest themselves, viz.: (1) that it is due to desiccation, (2) that it is due to the operation of "lysozyme," and (3) that it is due to the concentration of the salts of sweat by excretion. The first of these appeared to be very unlikely in view of the rapidity of the disappearance of *B. proteus* and *B. friedlanderi*. The following simple experiments showed that desiccation can play but a small part in the phenomenon.

A broth culture of various microbes was smeared very thinly over the outside of the closed end of several test tubes, and these were set up to dry at 37° C. At intervals, as shown below, one of the tubes was swabbed with sterile broth just as the fingers had been in Experiments 1-6, and bacterial counts made.

Strep. pyogenes.

Exp. 7. Test tube No. 1, dried for 25 min., gave	924,000 colonies	<i>Strep. pyogenes.</i>
" " 2 " " 2 hours	1,190,000	" "
" " 3 " " 4 hours	945,000	" "
" " 4 " " 28 hours	718,000	" "

B. coli.

Exp. 8. Test tube No. 1, dried for 25 mins., gave	560,000 colonies.
" " 2 " " 150 "	290,000 "
" " 3 " " 22 hours	66,500 "

A similar result was obtained when cultures of *B. proteus* and *B. prodigiosus* were dried on glass.

The action of lysozyme appeared at one time to offer a more likely explanation. My colleague Prof. A. Fleming (13) had demonstrated several years ago that fragments of skin, like many other body tissues, contained this rapidly acting bactericidal principle. This hypothesis, however, also appeared rather improbable when it was found that the microbe which has proved, facile princeps, the most susceptible to lysozyme action, i.e., *M. lysodeikticus*, is not so rapidly killed on the skin as those employed in Experiments 1 to 6.

The third hypothesis, therefore, is regarded for the present as the most plausible, but direct evidence in support of it has not yet been obtained.

The Effect of Washing alone upon the Microbic Flora of the Hands.

It has often been shown that ordinary washing with soap and hot water will sometimes increase the number of viable staphylococci on the skin of the hands. My own experience confirms this.

I have not met with any evidence, however, as to the effect of washing upon the fortuitous flora of the hands, i.e., the bacteria implanted upon them by chance contact with infective material, droplet contamination from the mouth, etc.

In order to determine this 2 or more fingers* were smeared with infective material of a "sticky" character and thoroughly dried. After 15 to 20 minutes one finger was swabbed with sterile broth and bacterial counts made as in experiments 1 to 6. The hands were then washed in hot water with

* The skin of the hands employed for all experiments in this investigation was normal. The nails were kept short.

ordinary toilet soap, and a nail brush used for the nails. After drying on a sterile towel the second infected finger was swabbed and a bacterial count made.

- Exp. 9. Fingers infected with saliva, *Strep. pyogenes* and *Staphylococci*.
Dried for half an hour.
One finger, before washing, gave 462,000 colonies (*S. pyogenes* 150,000).
2nd finger, after washing, gave 263,000 colonies (*S. pyogenes* nil).
- Exp. 10. Fingers infected with pure broth culture *Strep. pyogenes* and dried 10 mins.
One finger, before washing, gave 8,500,000 cols. (*S. pyogenes* 7,000,000).
2nd finger, after washing, gave "many" staphylococcal colonies and 3,500 cols *S. pyogenes*.
- Exp. 11. Fingers infected with saliva, *Strep. pyogenes* and *Staphylococci* and dried 45 mins.
One finger, before washing, gave 840,000 cols. (*S. pyogenes* 400,000).
2nd finger, after washing, gave 157,000 cols. (*S. pyogenes* "a fair number").
- Exp. 12. Fingers infected with thick pus containing *Staphylococci* and *Strep. pyogenes*.
One finger, before washing, gave 784,000 colonies (*S. pyogenes*, 24,500).
2nd finger, after washing, gave 2,800 colonies (*S. pyogenes*, nil).
- Exp. 13. Fingers infected with broth. culture of *B. prodigiosus*.
One finger, before washing, gave 11,200 colonies *B. prodigiosus*.
2nd finger, after washing, gave 1,400 colonies *B. prodigiosus*.

These records show that mechanical cleansing by soap and water, and a brush lightly applied round the nail sulci, will suffice to remove a large proportion—sometimes all—of the haemolytic streptococci and other microbes which have previously dried upon the hands in a sticky medium such as saliva or pus. It usually reduces—but will sometimes increase—the number of staphylococci which may be cultivated from the hands. In my experience and that of most investigators it never completely removes them.

The Effect of Treatment by Perchloride of Mercury and by Lysol upon the Normal Flora of the Hands, and upon Streptococci artificially implanted upon the Hands.

Special attention has been directed to the efficacy of these two antiseptics, because they are more commonly employed than any other for obstetric work in this country. In the first experiments (14 and 15) the procedure tested is that usually taught to students and pupil midwives.

Series 1. Observations of the Effect upon the Normal Flora of the Hands.

Four nurses who soaked their hands in perchloride of mercury, after washing, and two medical men who used lysol, were investigated.

Procedure.—All the fingers of the left hand were first swabbed with sterile broth and cultures made from the swabbings after appropriate dilution to determine the number of viable microbes. Both hands were then thoroughly washed for 2 to 3 minutes in unsterilised warm water with yellow soap, a nail brush being also used. Without drying they were next soaked up to the wrists in the perchloride or lysol solution for 3 minutes, the antiseptic being worked into the nail bed and sulcus with a piece of gauze. After rinsing in a bowl of sterile water the hands were dried on a sterile towel. Finally, when dry, all the fingers of the right hand were swabbed with sterile broth and a bacterial count made as before.

Results with perchloride of mercury (0.1% solution in water).

Exp. 14.	Nurse D.	Left hand	224,000 colonies mostly staphylococci.
		Right hand (treated)	7,600 " " "
	Nurse C.	Left hand	100,800 " " "
		Right hand (treated)	5,600 " " "
	Nurse W.	Left hand	26,000 " " "
		Right hand (treated)	9,600 " " "
	Nurse O.	Left hand	86,000 " " "
		Right hand (treated)	9,600 " " "

*Results with Lysol (0.62%, i.e., 1 drachm to 1 pint).**

Exp. 15.	Dr. O.	Left hand	508,000 colonies, mostly staphylococci.
		Right hand (treated)	45,000 " " "
	Dr. H.	Left hand	203,000 " " "
		Right hand (treated)	4,000 " Staphylococci and some diphtheroids.

Series 2. Observations of the Effect upon Streptococci Artificially Implanted upon the Hands.

In these experiments the fingers were first infected and dried. The washing was also sometimes more prolonged than in Experiments 14 and 15.

Results with Perchloride of Mercury (0.1%).

- Exp. 16. Fingers infected with saliva, *Strep. pyogenes* and staphylococci. Washing 5 minutes; perchloride 3 minutes, followed by ammonium sulphide to prevent transfer of any perchloride to the culture medium.
One finger, before washing, 616,000 colonies (*Strep. pyog.* 200,000).
2nd finger, after perchloride, 63,000 colonies (*Strep. pyog.* nil).
- Exp. 17. Fingers infected as in Exp. 16. Washing 5 minutes; perchloride, etc., as in Exp. 16.
One finger, before washing, 840,000 colonies (*Strep. pyog.* about 400,000).
2nd finger, after perchloride, 287,000 colonies (*Strep. pyog.* nil).
- Exp. 18. Fingers lightly infected with pus and blood, containing *Strep. pyogenes* and *Staph. aureus*. Dried 35 minutes. Washing about 2 minutes; perchloride 3 minutes. Hand rinsed after in ammonium sulphide and sterile water.
One finger, before washing, 7 million colonies (*S. pyogenes* 2,450,000).
2nd finger, after perchloride 112,000 colonies (*S. pyogenes* 280).

Results with Lysol (0.62%).

- Exp. 19. Subject L.C.
Fingers infected as in Exp. 16. Washing 5 minutes; lysol 3 minutes, hand rinsed after in sterile water, 1 litre.
One finger, before washing, 462,000 colonies (*Strep. pyog.* 150,000).
2nd finger, after lysol, 179,000 colonies (*Strep. pyog.* nil).
- Exp. 20. Subject R.H. Fingers lightly infected with blood and pus containing staphylococci and *Strep. pyogenes*. Washing 2-3 minutes; lysol 3 minutes; hand rinsed after in two changes (1 litre each) of sterile water.
One finger, before washing, 9,100,000 colonies (*S. pyog.* 2,100,000).
2nd finger, after lysol, 4,200 colonies (*S. pyog.* 70).

* The Lysol used in all these experiments was the ordinary laboratory stock as supplied by Messrs. Evans Sons, Lescher and Webb. It is their first-grade solution, designated Evansol, and standardised to contain 50% cresol.

It is seen that very similar results were obtained with perchloride and the brand of lysol here employed. Sterilisation in the bacteriological sense was never achieved—staphylococci being always cultivated in considerable numbers after treatment. Comparatively small implantations of streptococci dried upon the hands with saliva were killed (or mechanically removed), but a few survived when the hands were heavily infected with pus.

In view of the fact that in midwifery practice (and in surgery) these antiseptics are frequently used *without previous washing* for the purpose of re-sterilising hands which may have been in contact with infective material subsequent to their original "toilet" it was thought desirable to ascertain how far they can be relied upon to kill haemolytic streptococci when so employed.

In planning the following experiments a period of three minutes for treatment of the hands was arbitrarily chosen as being the maximum likely to be devoted to re-sterilisation in routine obstetric practice.

Results with Perchloride (Without Previous Washing).

- Exp. 21. Fingers infected with saliva, *Strep. pyogenes* and staphylococci. Perchloride (0.1%) 3 minutes. Hand rinsed after in water. One finger, before perchloride, 399,000 colonies (*Strep. pyog.* "many thousands").
2nd finger, after perchloride, 29,680 colonies (*Strep. pyog.* 7,000).
- Exp. 22. Fingers infected with saliva and *Strep. pyogenes*. Dried 25 minutes. Perchloride (0.1%) 3 minutes, lightly worked in with lint swab. Hand soaked after in ammonium sulphide. One finger, before perchloride, 4,550,000 colonies (*S. pyog.* about 4 million).
2nd finger, after perchloride, 616,000 colonies (*S. pyog.* 5,250).
- Exp. 23. Fingers lightly infected with thin pus containing *Strep. pyogenes* and staphylococci. Perchloride (0.2%) 3 minutes lightly worked in with swab. Hand soaked after in ammonium sulphide. One finger, before perchloride, 8,960,000 colonies (*S. pyog.* 2,100,000).
2nd finger, after perchloride, 22,750 colonies (*S. pyog.* 2,450).

Results with Lysol (Without Previous Washing).

- Exp. 24. Fingers infected with saliva, *Strep. pyogenes* and staphylococci—dried 45 minutes. Lysol (0.62%) 5 minutes, lightly worked in with swab. Hand rinsed after in 1 litre water. One finger, before lysol, 18,200 colonies (*S. pyog.* 7,000).
2nd finger, after lysol, 35,000 colonies (*S. pyog.* nil).
- Exp. 25. Fingers infected with saliva and *Strep. pyogenes*. Dried 40 minutes. Lysol (0.62%) 3 minutes, lightly worked in with swab. Hand rinsed after in 2 changes of sterile water (1 litre each). One finger, before lysol, 6,100,000 colonies (*S. pyog.* 5,900,000).
2nd finger, after lysol, 100,800 colonies (*S. pyog.* 7,800).
- Exp. 26. Fingers infected with broth culture *Strep. pyogenes*. Dried $\frac{1}{2}$ hour. Lysol (0.3%) 3 minutes, lightly worked in with swab. Hand rinsed after in 2 changes sterile water (1 litre each). One finger, before lysol, 2,700,000 colonies (*S. pyog.* 1,750,000).
2nd finger, after lysol, 268,000 colonies (*S. pyog.* "many thousands").

These results show that neither perchloride (0.1 or 0.2%) nor lysol (0.625%) can be relied upon to kill haemolytic streptococci on the *unwashed* hands within three minutes. Lysol was, however, successful when the hands were soaked in it for 5 minutes.

In the next section a similar test was applied to several other antiseptics.

The Effect of Various Disinfection Procedures, other than Treatment by Perchloride and Lysol, which have been Advocated for the Sterilisation of the Hands.

The experiments reported in this section had a twofold purpose, viz. (1) to determine whether haemolytic streptococci dried upon the hands as in previous tests could be killed within three minutes *without previous washing* (Series A).

(Alcohol was not included among the agents tested because it has proved unsuitable for frequent application to the hands on account of the roughness which it causes. Probably some of the agents which were tested would be found equally unsuitable, but definite information on this point was not available.)

(2) To determine whether hands can be *completely sterilised* by any of the procedures for which this has been claimed (Series B).

Series A.

- Exp. 27. Subject L.C. Fingers infected lightly with pus containing *Staph. aureus* and *Strep. pyogenes*. Dried 25 minutes.
Iodine (1% in 1% *potassium iodide*). 3 minutes; followed by sodium thiosulphate and sterile water.
 One finger, before iodine, 10,800,000 colonies (*S. pyog.* 4,900,000).
 2nd finger, after iodine, 189,000 colonies (*S. pyog.* nil).
- Exp. 28. Subject C.E.D. Fingers lightly infected with pus containing *Staph. aureus* and *Strep. pyogenes*. Dried $\frac{1}{2}$ hour.
Chloramine T (1%). 3 minutes; hand rinsed after in two changes of water (1 litre each).
 One finger, before Chloramine T, 8,500,000 colonies (*S. pyog.* 1,750,000).
 2nd finger, after Chloramine T, 4,410 colonies (*S. pyog.* nil).
- Exp. 29. Subject L.C. Fingers lightly infected with pus containing *Strep. pyogenes* and *staphylococci*.
Formalin (3% in 5% *glycerin*). 3 minutes; hand rinsed after in two changes (1 litre each) of sterile water.
 One finger, before formalin, 4,400,000 colonies (*S. pyog.* 2,100,000).
 2nd finger, after formalin, 200,000 colonies (*S. pyog.* 19,600).
- Exp. 30. Subject C.E.D. Fingers lightly infected with pus as above.
Monsol (0.2%), 3 minutes; hand rinsed after in two changes (1 litre each) of sterile water.
 One finger, before Monsol, 8,000,000 colonies (*S. pyog.* 1,610,000).
 2nd finger, after Monsol, 84,000 colonies (*S. pyog.* 39,200).
- Exp. 31. Subject C.E.D. Fingers lightly infected with blood and pus containing *Strep. pyogenes* and *Staph. aureus*. Dried $\frac{1}{2}$ hour.
Monsol (0.5%), 3 minutes; hand rinsed after in sterile water, two changes.
 One finger, before Monsol, 11,900,000 colonies (*S. pyog.* 1,400,000).
 2nd finger, after Monsol, 39,500 colonies (*S. pyog.* 5,600).
- Exp. 32. Subject L.C. Fingers infected with saliva and *Strep. pyogenes*.
Eupad (*Chlorinated lime and boric acid*, 0.15% of each), 3 minutes; hand rinsed after in two changes of sterile water.
 One finger, before Eupad, 7,200,000 colonies (*S. pyog.* 7,000,000).
 2nd finger, after Eupad, 84,000 colonies (*S. pyog.* 1,610).

As it was represented to me that Izal would be likely to give better results than most of the antiseptics I had tested, the following experiments were carried out—on unwashed hands, just as in Exps. 27 to 32.

- Exp. 33. Subject L.C. Fingers lightly infected with pus containing *Strep. pyogenes*. Dried 30 minutes.
Izal (0.25%, i.e., as recommended by the makers for the

- sterilisation of hands), 3 minutes; hands rinsed after in two changes of sterile water.
 One finger, before Izal, 1,220,000 colonies (S. pyog. 980,000).
 2nd finger, after Izal, 1,470,000 colonies (S. pyog. 140,000).
- Exp. 34. Subject L.C. Fingers infected as before. Dried $\frac{1}{2}$ hour.
 Izal (0.5%), 3 minutes; hand rinsed after in two changes of sterile water.
 One finger, before Izal, 1,400,000 colonies (S. pyog. 511,000).
 2nd finger, after Izal, 378,000 colonies (S. pyog. 700).
- Exp. 35. Subject L.C. Fingers infected as before. Dried 25 minutes.
 Izal (1.0%), 3 minutes; hand rinsed after in two changes of sterile water.
 One finger, before Izal, 1,400,000 colonies (S. pyog. 1,260,000).
 2nd finger, after Izal, 230,000 colonies (S. pyog. 2,100).

It is seen that haemolytic streptococci were cultivated from the fingers after treatment for 3 minutes by each of these antiseptics—except 1 per cent. iodine and 1 per cent. chloramine T.

Series B.

In some of these experiments the number of streptococci surviving was not separately determined.

- Exp. 36. *Chlorinated lime and boric acid (Eupad)* (0.15% of each). Fingers infected with saliva, strep. pyogenes and staphylococci. Eupad solution... 3 minutes after washing; hands rinsed after in water.
 Two fingers before washing gave "many thousands" of colonies.
 Two fingers after Eupad gave "about 10,000" colonies.
- Exp. 37. *Schumburg's solution (absolute alcohol, ether and nitric acid)*. Fingers not artificially infected. Solution applied 3 minutes, without washing; hand rinsed after in water.
 Two fingers, before treatment, 26,000 colonies.
 Two fingers, after treatment, 2,000 colonies.
- Exp. 38. *Ether soap followed by "surgical spirit"* (i.e. industrial spirit, 64 over proof, with 2½% castor oil). Fingers not artificially infected.
 Ether soap with few drops of water and brush for nails, 2 minutes; surgical spirit 2 to 3 minutes.
 Three fingers, before treatment, 266,000 colonies.
 Three fingers, after treatment, 189,000 colonies.
 The experiment was repeated with same result.
- Exp. 39. *Iodine (0.5% in 1% potassium iodide)*. Fingers lightly infected with pus and blood containing staphylococci and Strep. pyogenes.
 Washing 2-3 minutes, iodine 3 minutes; hand rinsed after in sodium thiosulphate and sterile water.
 One finger, before washing, 9,000,000 colonies (S. pyog. 2,100,000).
 2nd finger, after iodine, 105,000 colonies (S. pyog. 70).
- Exp. 40. *Chloramine T (1%)*. Fingers lightly infected with pus and blood as in Experiment 36. Washing 2-3 minutes; Chloramine T 3 minutes; hand rinsed after in sodium thiosulphate and sterile water.
 One finger, before washing, 5,000,000 colonies (S. pyog. 1,750,000).
 2nd finger, after chloramine, 140,000 colonies (S. pyog. nil).

The combination of mechanical cleansing with antiseptic action (Experiments 36, 38, 39, 40) did not suffice to get rid of staphylococci from the fingers in any instance. A mixture of absolute alcohol with ether and nitric acid, which Schumburg had found most effective without previous washing of the hands, was also unsuccessful. Streptococci dried on the hands in a mixture of pus and blood were completely eliminated by washing combined with Chloramine T; and almost completely by a $\frac{1}{2}$ % solution of iodine.

*The Chemical Sterilisation of Rubber Gloves on the Hands.**

Although it is widely recognised that rubber gloves can be sterilised by antiseptics I have been unable to find precise data bearing upon the subject except the statement of Theobald and Bigger (14) that treatment for 1 minute in a 0.1% solution of biniodide of mercury, after washing, is sufficient for the purpose. That statement is a little misleading because it suggests that the antiseptic plays the more important part. The following experiment shows that washing alone removes the great majority of the organisms.

Exp. 41. *Washing alone.* Glove infected with pus containing Strep. pyogenes and staphylococcus. Dried.

One finger, before washing, 784,000 colonies (S. pyog. 24,500).
2nd finger, after washing, 2,800 colonies (S. pyog. nil).

The experiments which follow were carried out precisely as the earlier ones with naked hands. The first one (No. 42) shows that treatment for one minute by a 0.1% solution of biniodide *without previous washing* was not very successful.

Exp. 42. *Biniodide of mercury (0.1%) watery solution, without previous washing.* Glove infected with pus and blood containing Strep. pyogenes and staphylococci. Dried 30 minutes. Biniodide applied with lint swab, 1 minute 5 seconds; hand rinsed after in ammonium sulphide and sterile water.

One finger, before biniodide, 10,000,000 colonies (S. pyog. 7,000,000).
2nd finger, after biniodide, 2,100 colonies (S. pyog. 1,260).

Exp. 43. *Biniodide of mercury (0.4%) in 50% spirit, without previous washing.* Gloves heavily infected with pus and blood containing Strep. pyogenes and staphylococci. Dried $\frac{1}{2}$ hour. Biniodide applied with lint swab 2 minutes; hand rinsed after in ammonium sulphide and sterile water.

One finger, before biniodide, 5,250,000 colonies (S. pyog. 3,570,000).
2nd finger, after biniodide, 0 colonies.

Exp. 44. *Lysol (2%), without previous washing.* Gloves heavily infected with blood and pus containing Strep. pyogenes and staphylococci. Dried 35 minutes. Lysol applied with lint swab $1\frac{1}{2}$ minutes; hand rinsed after in two changes sterile water, 1 litre each.

One finger, before lysol, 13 million colonies (Strep. pyog. $10\frac{1}{2}$ millions).
2nd finger, after lysol, 42 colonies (Strep. pyog. nil).

Exp. 45. *Perchloride of mercury (0.5%), without previous washing.* Gloves heavily infected with pus containing Strep. pyogenes and staphylococci. Dried one hour. Perchloride applied with lint swab $1\frac{1}{2}$ minutes; hand rinsed after in ammonium sulphide, followed by sterile water.

One finger, before perchloride, 4,000,000 colonies (S. pyog. 1,085,000).
2nd finger, after perchloride, 56 colonies (S. pyog. nil).

Exp. 46. *Chloramine T (1%), without previous washing.* Glove infected with saliva and cultures of Strep. pyogenes and staphylococcus. Chloramine T applied with lint swab 2 minutes; hand rinsed after in sterile water.

One finger, before chloramine T, 11,200,000 colonies (S. pyog. $8\frac{1}{2}$ millions).
2nd finger, after chloramine T, nil.

Exp. 47. *Chloramine T (2%), without previous washing.* Gloves infected with pus containing Strep. pyogenes and staphylococci. Dried 25 minutes. Chloramine T applied with lint swab, $1\frac{1}{2}$ minutes; hand rinsed after in sterile water.

* The gloves employed in these experiments were of smooth, thin, red rubber, of German manufacture, and sold for domestic purposes by Messrs. Woolworth. I am advised that they are sufficiently thin (they vary a little) for routine obstetric purposes, though possibly not for the "operations" of midwifery.

One finger, before chloramine T, 15,100,000 colonies (*S. pyog.* 10,500,000).

2nd finger, after chloramine T, 70 colonies (*S. pyog.* nil).

Exp. 48. *Carbolic acid* (1%), *without previous washing*. Glove infected with pure broth cultures, *Strep. pyogenes* and *staphylococcus*. Carbolic applied with lint swab, 2 minutes; hand rinsed after in sterile water.

One finger, before carbolic, 950,000 colonies (*S. pyog.* 650,000).

2nd finger, after carbolic, 14 colonies (*S. pyog.* nil).

These results show that large numbers of haemolytic streptococci dried upon the gloved hand along with staphylococci and saliva or pus were completely killed by contact for $1\frac{1}{2}$ or 2 minutes (without previous washing) with biniodide of mercury in spirit, lysol, perchloride, chloramine T or carbolic acid. The very small number of colonies—of staphylococci and air-borne bacteria—which were cultivated from the gloves in some of the experiments after disinfection, may justifiably be disregarded. Some of them, no doubt, were attributable to contamination from the air in the process of swabbing the fingers, etc. Bacteriologists will appreciate that it is difficult to conduct experiments of this kind in an ordinary laboratory where several people are working without getting a few such contaminations.

SUMMARY OF RESULTS.

1. Cultures made from the hands of 45 normal individuals—nurses, medical men, and laboratory attendants—taken at random while at work, yielded no colonies of haemolytic streptococci. It is highly probable that *Streptococcus pyogenes*, unlike the *Staphylococcus*, is unable to establish itself in the various fissures, sweat glands, etc., of the normal skin.

2. *Streptococcus pyogenes*, *B. coli*, *B. proteus* and the bacillus of Friedlander, when implanted upon the hands, were rapidly destroyed. The nature of this bactericidal process is not yet clear. Whatever the explanation there can be little doubt that the operation of this protective mechanism must diminish the chances of transfer of pathogenic bacteria on the hands of those attending midwifery or surgical cases.

3. Washing with soap and warm water gets rid of many—sometimes all—of the haemolytic streptococci previously implanted and allowed to dry upon the hands. Staphylococci always persist after washing, but usually in reduced numbers. Occasionally the number appears to be increased.

4. When preliminary washing was omitted treatment of the infected hands for 3 minutes by perchloride of mercury (0.1%) or by lysol (0.62%) did not suffice to get rid of haemolytic streptococci. The combination of mechanical cleansing by soap and water with treatment by perchloride or lysol was effective for hands infected with a comparatively small number of haemolytic streptococci and saliva; *but the streptococci were not completely killed when they were present in comparatively large numbers along with traces of dried pus and blood*. Under these last conditions complete elimination of streptococci was obtained only by treatment with Chloramine T (1%) after washing. (One experiment.)

5. Treatment for 3 minutes by formalin (3%), Monsol (0.5%) and Eupad (0.3%) failed to kill haemolytic streptococci on the unwashed hands. The same streptococci did not survive a similar exposure to 1% solutions of iodine and chloramine T.

6. Treatment of the normal hands, with or without previous washing, did not kill the microbes (chiefly staphylococci) which are habitually established on the skin. One thousand colonies, or more, have grown in every instance from the washings of a single finger.

7. Smooth rubber gloves on which infected blood and pus had been dried were completely freed from haemolytic streptococci by simple washing in soap and water. A small number of staphylococci could still be recovered from them.

Complete, or almost complete, sterility of gloves so infected was obtained by soaking, without previous washing, in—

- perchloride of mercury (0.5%) for 1½ minutes.
- lysol ("Evansol") 2% for 1½ minutes.
- chloramine T 2% for 1½ minutes.
- carbolic acid 1% for 2 minutes.
- biniodide of mercury, 0.4% in 50% alcohol for 2 minutes.

CONCLUSIONS.

Sterilisation of the hands aims at preventing the transfer of pathogenic bacteria to the genital passages of the mother (a) by an initial thorough antiseptic toilet and (b) by further treatment from time to time during the course of labour in case the hands have become contaminated by contact with infective material. It is not, perhaps, generally recognised that this contact with infective material may be only a sub-perceptible contact. The hands may be reinfected with streptococci by salivary spray ejected by coughing, sneezing, and even in the course of conversation.

Haemolytic streptococci, indistinguishable from those which cause puerperal infections, are known to be present from time to time in the fauces of a certain number of people. It sometimes happens that the parturient woman herself, or one of her attendants, is one of these people. In that event streptococci, potentially dangerous, are being unconsciously sprayed into the air around the patient during the period of labour. Some of them will reach the hands of the attendant and so, indirectly, may be transferred to the vulva or vagina.

The experiments here reported show that the initial antiseptic toilet as commonly advocated in this country, viz., thorough washing, followed by treatment of the hands for 3 minutes with perchloride of mercury (0.1%) or lysol (0.62%) of good quality will usually succeed, if it is conscientiously carried out, in getting rid of any haemolytic streptococci with which the hands have become contaminated. Washing alone removes the greater number of such streptococci. It must be emphasised, however, that these procedures do not sterilise the hands in the bacteriological sense. Staphylococci, and sometimes diphtheroid bacilli, can still be cultivated from them. Moreover, as a means to the elimination of streptococci, this antiseptic toilet offers only a small margin of safety. If the washing is perfunctory, or the strength of the antiseptic solutions is reduced, or, again, if the streptococcal contamination of the hands is a heavy one and combined with serous discharges, killing is likely to be incomplete.

There would seem to be little to choose between perchloride of mercury and a lysol of good quality, such as the one employed in my experiments, for the initial antiseptic toilet of the hands. In view, however, of the fact that lysol is somewhat more prone to irritate the skin (and in consequence is often used in very dilute solution), and the further fact that the several brands of lysol now on the market have different characters and bactericidal potency, there is much to be said for discontinuing the use of these products in midwifery until such time as their manufacture is so regulated as to ensure uniformity of bactericidal power combined with low toxicity for skin tissues.

Iodine (0.5–1%) or chloramine T (1%) are more efficient for killing haemolytic streptococci on the hands than either perchloride or lysol and should be tried. Their use is open to some objections (smell, staining, etc.), and it is not unlikely that they would be found too irritant for frequent use.

* * * * *

The problem of re-sterilisation of the hands at intervals is more difficult. The midwife needs for this an antiseptic solution which can be relied upon to kill streptococci on the hands quickly, i.e., within 2 or 3 minutes at most—and without previous washing. Only iodine and chloramine T. have been found to fulfil this condition. Perchloride (even 0.2%) and lysol (0.62%) do not.

* * * * *

The situation may be summed up as follows: for the ordinary run of clean midwifery practice the measures usually employed to prevent the transfer of pathogenic streptococci on the hands to the parturient woman will usually suffice.

They do not, however, offer a sufficient safeguard when circumstances favour the epidemic spread of puerperal infection, i.e., when those attending the labour, or the patient herself, are carriers of pathogenic strains.

Since the occurrence of these circumstances cannot be foreseen, it is desirable, in the interests of safer childbirth, *that rubber gloves should be much more widely employed in all midwifery work.* Smooth, thin gloves can now be bought very cheaply, and, if not heated, wear well. Their sterilisation on the hands is very readily effected, with or without washing, e.g. by perchloride of mercury (0.5%) or biniodide in spirit (0.4%) or carbolic acid (1%).

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- (Number of Volume in italics.)

APPENDIX E.

The Need for Bacteriological Services in the Control of Puerperal Infections.

By LEONARD COLEBROOK, M.B., B.S., and F. GRIFFITH, M.B., Ch.B.

Bacteriology should be called upon to contribute in a much larger measure than heretofore to the prevention and the treatment of puerperal fever. The contribution it can make is of several kinds.

Firstly, it enables us to recognise *at an early stage* the case infected by haemolytic streptococci. Too often in the past the gravity of a patient's illness and the need for energetic treatment have only been suspected after 3 or 4 days of fever which does not subside. Then—too late—she is removed to hospital and treatment started, at a time when there is little hope of overtaking the infection. It cannot be too strongly emphasised that clinical signs and symptoms often do not enable us to distinguish with any certainty in the early stages of puerperal fever between the infections by haemolytic streptococci and the more common, but less serious, infections by other organisms. The failure to make that differentiation is responsible for many of the deaths from puerperal fever. By the simple precaution of taking a swab from the patient at the first sharp rise of temperature, say about 101° F., the case infected by haemolytic streptococci would be detected within 24 hours. If no haemolytic streptococci are found the bacteriological report is still of value. The doctor is reassured as to the immediate prognosis and is guided in his decision as to the necessity for moving his patient to hospital. Further, he will not, as so frequently in the past, adopt a line of treatment, such as the injection of anti-streptococcal serum, which is quite inappropriate to the case, may do harm and may cause much misery. A sterile culture, or one nearly sterile, tells him that the infection is probably not a uterine one, and that he should look elsewhere for the explanation of the fever. An abundant culture of *B. coli* or of anaerobic streptococci indicates the true nature of the uterine infection and the need for treatment, either local, e.g. by glycerine, or general, by the appropriate vaccine.

Secondly, bacteriological investigation enables us to devise intelligent measures to prevent the spread of infections by haemolytic streptococci. When a case occurs in a Maternity Institution previously free from infection, a bacteriologist's report will, within 24 hours of the onset of fever, not only show the need for the immediate isolation of the patient, and for redoubled antiseptic precautions, but also may make it possible to trace the source of the infection, e.g. to a throat carrier of *Streptococcus pyogenes* among the staff or the patients. If such enquiry is delayed for several days it may happen that the carrier condition has already extended to other members of the staff, rendering it more difficult to detect the original source of the infection and prevent further spread. In these circumstances further cases of puerperal infection are apt to develop and it becomes necessary to close down the Institution for the time being.

Thirdly, bacteriological investigation enables us to be forewarned of danger from carriers of haemolytic streptococci. There is reason to believe—although it is not yet fully established by evidence—that the carrier of haemolytic streptococci in a throat quite free from inflammation is much less dangerous than the carrier who has a mild tonsillitis or laryngitis caused by these streptococci. Pending further evidence on the matter it would seem to be very desirable that in Maternity Institutions and District Midwifery Associations all such instances of mild throat infection should be reported and examined bacteriologically.

Fourthly, bacteriological methods must play an increasingly large part in the future in the development and testing of therapeutic remedies for puerperal fever.

BACTERIOLOGICAL PROCEDURES APPLICABLE TO THE INVESTIGATION OF A CASE OF PUERPERAL FEVER.

The following procedures may be recommended.

1. For the Examination of Material from the Genital Tract.

The sample is collected on a cotton wool swab (preferably mounted on pewter wire which is easily bent to an angle of about 20° at its end) from the upper vagina or (better) from the cervix uteri. In cases of several perineal or vaginal lacerations a swab from the lower vagina should suffice.

On arrival at the laboratory the swab is rubbed on two blood-agar plates. (*vide infra* for the method of making these), using a small sector of each plate, and the explanted material is subsequently distributed thinly over the rest of the plates by a platinum wire, or a glass rod bent at right angles. One plate is incubated aerobically, the other anaerobically in a McIntosh and Fildes jar. If the case from which the swab was taken is one of severe haemolytic streptococcus infection the aerobic plate will show an abundant, almost pure, culture of these organisms, easily recognisable within 20 hours by the decolorised zones around the colonies. There will seldom be any doubt as to the nature of the infection when such cultures are obtained. If the aerobic plate shows no typical haemolytic streptococcal colonies, or very few of them, the anaerobic plate should be left in the incubator for a further 24 hours to give time for the development of anaerobic streptococci.

2. For the Cultivation of Organisms from the Patient's Blood.

(When the swab from the cervix has given an abundant culture of haemolytic streptococci examination of the patient's blood is not necessary unless we wish to determine whether the infection has become generalised. On the other hand, when the culture made from the genital tract shows no haemolytic streptococci but mixed colonies of several microbic types, blood culture will often reveal the true nature of the patient's infection. In such cases strictly anaerobic, as well as aerobic methods should be employed, since there is evidence that cases of this kind often have a generalised infection by anaerobic streptococci, which may easily be missed unless specially sought for.)

Four c.cms of the patient's blood, taken from a vein with due aseptic precautions, is distributed as follows:—

(a) 1 c.cm into a large ampoule containing 1 c.cm of 5% solution of sodium chloride. The mouth of the ampoule is then closed with sealing wax and the contents thoroughly mixed. On returning to the laboratory the contents are transferred to a Petri dish, mixed with several c.cms of sterile broth, and finally with 15-20 c.cms of melted agar at a temperature of about 47° C.

This plate culture, when the agar has set, is incubated aerobically. It serves, in a case of septicaemia due to haemolytic streptococci, to tell us approximately the number of streptococci free in the patient's blood stream—information which is often of some value for prognosis.

(b) 1 c.cm into a tube of glucose broth (10 c.cm) to which about 0.3 c.cm of sterile trypsin (Fairchild's Injectio Trypsini Co.) has been added—and thoroughly mixed—with a pipette. (The trypsin is added in order to prevent clotting and at the same time antagonize the antibacterial elements of the blood. *Vide* Douglas and Colebrook, "Lancet," 1916, ii. 180.)

(c) 1 c.cm into a tube of the same medium as in (b) supra but prepared in a slightly different manner with a view to favouring the growth of anaerobic bacteria; the glucose broth is thoroughly boiled and is then quickly cooled; the trypsin is added and mixed, and the whole covered with a layer of melted vaseline. When required for the blood culture the tube is warmed round the layer of vaseline and then sloped. This serves to break the vaseline seal and permits the introduction of the blood into the broth. When that is accomplished the seal is easily re-established by again warming the tube at the top of the fluid and setting it upright.

(d) 1 c.cm into a tube of meat-broth medium prepared as described by Lepper and Martin (Brit. Jour. Exp. Path., 1929, x, 327) and covered with a layer of liquid paraffin.

Growth of haemolytic streptococci or of other aerobic species will usually be evident, even to the naked eye, after 24 hours' incubation in the tube (b). The growth of anaerobic streptococci is always much less evident—it should be sought for in tubes (c) and (d) after two and four days' incubation by film examination and subculture on blood agar.

3. For the Examination of the Patient's Urine.

The centrifuged deposit of a catheter specimen is examined by stained films and by cultivation on plates of blood agar, and McConkey's or other selective medium.

Epidemiological Investigation in Puerperal Fever of Haemolytic Streptococcal Origin.

In cases of puerperal sepsis caused by haemolytic streptococci it should be the aim to discover the source of infection, and an attempt should be made whenever circumstances permit. With this object in view throat swabs should be taken from any person in contact with the patient as well as from the patient herself. Other possible sources of infection, such as children in the house with ear discharges or tonsillitis, should be examined.

Since haemolytic streptococci are widely distributed and are of not uncommon occurrence in apparently normal throats, their discovery in any of the above situations indicates merely a potential source of infection; to establish their aetiological connection with the puerperal disease it is necessary to identify the puerperal strain with that from the suspected contact.

It is essential, therefore, to obtain all strains in pure culture and to subject them to comparative tests. These may include the appearances of the colonies in spread and poured plates, and the fermentation reactions with different sugars. The character of the surface colonies and the haemolytic activity of two or more strains are best compared by planting them thinly on different sectors of the same blood plate. While the above tests are of value in differentiating one strain from another it is necessary, in order to establish their identity, to have recourse to serological methods.

Haemolytic streptococci from puerperal sepsis are not homogeneous; they comprise, on the contrary, a group of strains as diverse in their serological characters as those from other forms of sepsis, from tonsillitis and from scarlet fever. This extreme diversity of antigenic types in the group of haemolytic streptococci makes the identification of two strains a difficult and laborious procedure, since a very large number of different type sera are required. On the other hand, there is this advantage in the infrequent occurrence of a particular type that the presumptive evidence of infection is the stronger when the puerperal strain and that from the suspected contact are found to be of the same type.

The recommendation that tests should be carried out to establish the serological identity of strains of streptococci derived from puerperal cases with those of carriers who have been in contact with them is recognised to be at the present time a counsel of perfection. Much work on the classification of streptococci is still required and progress would be advanced by the appointment of one or more workers in a central laboratory who would prepare a large number of type sera and be available for carrying out the identification tests on strains submitted to them.

Characters of Puerperal Haemolytic Streptococci.

The haemolytic streptococci responsible for the production of puerperal fever belong to the streptococcus pyogenes group, in which are included the scarlatinal, septicaemic, tonsillitis and erysipelas streptococci. The distinguishing characteristic of streptococcus pyogenes—i.e., the destruction of the red corpuscles and the decolorisation of the haemoglobin ("beta haemolysis" of Brown, 1919), within a radius of 2-4 mm.—around the colonies on fresh blood agar plates, makes its presence easily recognisable. As it is important

that the results of different observers should be strictly comparable it is desirable that the blood added to the culture medium should be from one and the same species of animal; the red cells of the horse are recognised to be particularly suitable for the exhibition of haemolysis. In making the plates a layer of ordinary agar should first be allowed to set in the Petri dish, and this should be just covered by a second layer of agar containing 5 per cent. horse blood.*

While the recognition of colonies of *S. pyogenes* in throat cultures on the blood agar plate made as described above rarely presents difficulty it must be acknowledged that exceptions occur. Streptococci will sometimes be found which produce definite beta haemolysis, but in regard to their other characters appear to differ from the typical *S. pyogenes* of puerperal infections, scarlet fever, etc. The classification, and the best means of recognising these aberrant haemolytic strains, are subjects which require further investigation.

Finally, it may be recommended that in dealing with cultures from throat swabs the abundance or sparseness of the growth of haemolytic streptococcal colonies should be taken into account. There may be difficulty in deciding whether any administrative action ought to be taken on finding that a swab from a particular nurse or medical man has given one or two colonies of haemolytic streptococci, but there is little room for doubt when such a swab has given an abundant, almost pure culture.

SEROLOGICAL IDENTIFICATION.

Agglutination Tests. The chief difficulty in serological work with haemolytic streptococci is the obtaining of suspensions sufficiently uniform for agglutination tests. One way of obviating this difficulty to a considerable extent is to use the following slide method instead of the more customary water-bath method of carrying out the test. The strain is grown in serum broth, preferably from a plate colony which generally grows at the bottom of the tube; occasionally centrifuging will be necessary, but should be avoided when possible. Without disturbing the deposit the supernatant broth is pipetted off with the exception of about 0.5 c.c., in which the deposit is resuspended. Drops of this fairly thick suspension are placed on a slide and mixed with each of the available agglutinating sera, the result being watched under a low power microscope. When a strain gives immediate coarse flocculation with a particular serum it is possible that it may be of the same type as that from which the serum was prepared. But since cross-agglutination between strains and sera of different types is not uncommon agglutin-absorption tests must be made before the type can be identified with certainty.

Agglutinin-absorption Method. The following is a quick method of determining whether a culture will exhaust a serum of its homologous agglutinin. The centrifuged deposit of 100 c.cm. of glucose broth culture, contained in a bulk of 1.25 c.cm., is added to 0.05 c.cm. of the serum to be tested. The culture and serum are well mixed and centrifuged immediately. The supernatant serum-dilution is tested by the slide method for the presence of agglutinin. A control absorption test with the homologous strain is, of course, essential.

Preparation of agglutinating sera in rabbits. With certain strains of haemolytic streptococci agglutinating sera can be prepared with comparative ease, while other strains may fail even after a long series of injections to produce a type specific serum. A method of immunising rabbits, which has given fairly successful results is the following. The culture is grown in glucose broth for 6-8 hours; after heating to 60° C. for one hour it is centrifuged, the deposit collected and resuspended in 10 c.c. of salt solution. The rabbit is injected on two or three consecutive occasions in each week with gradually increasing doses, beginning with one c.c. of the suspension until the whole ten c.c. are injected in one week. A serum of sufficiently high titre for use with the slide method may be obtained after a course of treatment of 6 weeks to 3 months. The titre should be at least 1 in 80.

* Sterile horse blood for culture media may be obtained from Burroughs, Wellcome and Company.

APPENDIX F.

Ante-Natal Clinics: Their Conduct and Scope.*I. Introductory Considerations.*

It is acknowledged that, speaking generally, the present standard of ante-natal care remains below what is required for safeguarding the mother, even within the limits of our present knowledge. Some pregnant women receive no ante-natal supervision at all, and there is reason to believe that in other cases the supervision is so insufficient that harm may be done by giving a false sense of security.

It is important to obtain for every pregnant woman a high standard of examination and treatment, and it appears certain that a definite standard for such work would be helpful to those responsible for organising and administering ante-natal clinics, as a further step in the reduction of the present high mortality rate. The adequacy of such clinics necessarily affects the whole of the work done for the pregnant woman, not only at the present time, but in the future, since a proportion at least of these clinics are attended by medical students and pupil midwives, and the educational effects are thus far reaching.

II. Principles of Ante-Natal Care.

1. Every pregnant woman should receive sufficient ante-natal care to ensure that a difficult labour will be foreseen as far as this can be done by efficient examination. Such examination should include not only the pelvic and abdominal organs, but the general physical condition: the home conditions of the patient should be investigated as well.

2. Every woman should receive sufficient ante-natal supervision to ensure the early detection and treatment of toxæmia within the limits of our present knowledge.

3. Ante-natal care should include measures directed against infection (e.g., dental care, the treatment of infection of the cervix), and measures increasing the resistance to infection, as well as directions as to preparations for labour and the puerperium.

4. Measures should be taken to include within the scope of ante-natal care the diagnosis and treatment of venereal diseases.

5. The closest co-operation should be maintained between the clinic and all persons in whose charge the pregnant woman may be during pregnancy, labour and the puerperium.

6. In order that the high standard of ante-natal care which is necessary may be maintained by midwife and doctor, the educational effect of a well-organised clinic must be always kept in mind.

III. Application of Principles.

Details of the application of these principles are given below, and it must be realised that any restriction in the extent of the ante-natal care here described will diminish that degree of safety to the woman in childbirth which is possible in the present state of our knowledge. It is obvious that such intensive care can only be given when the patient actively co-operates with the clinic or doctor. Such co-operation can be facilitated by educational propaganda, and by the following up of cases to ensure regular attendance. A proportion of the necessary observations might well be made in the patient's home by the midwife, in co-operation with the clinic or practitioner.

IV. The Ante-Natal Clinic.

Ante-natal clinics may belong to two categories—namely (a) The Consulting Clinic, (b) the Clinic for routine Examination. The Consulting Clinic may serve both purposes, but there is always likely to be a large number of municipal clinics whose function will not be consultative. It is possible that under a reformed maternity service much of the work of such routine

examination clinics may be transferred to the family practitioner and the trained efficient midwife, but at present they are essential for securing ante-natal care where it would not otherwise be available.

The Consulting Clinic will necessarily be staffed by obstetricians of standing, since it could not otherwise adequately perform its functions, and it may therefore be assumed that the organisation, equipment, etc., will be sufficient for its purpose.

The Examination Clinic.—This is the type of clinic under consideration, and will be referred to subsequently simply as the “Ante-Natal Clinic.”

V. *The Organisation of an Ante-Natal Clinic.*

1. *Premises and Equipment.*

The success of a clinic will depend to a considerable extent on suitable premises being secured either in an existing institution or elsewhere; the essentials of warmth, cleanliness and privacy, are, however, comparatively easily obtained. The lack of a special building should not discourage organisers. An important consideration is the question of accessibility. The essential furniture and equipment are simple and inexpensive.

2. *The “Personnel.”*

(a) *The Medical Officer*.—The Medical Officer, whether whole or part time, should be trained and experienced both in obstetrics and ante-natal work, and should preferably have held a resident appointment in a maternity hospital, with experience at its ante-natal clinic. Failing this at least three months’ post-graduate instruction at a recognised school should be required if the Medical Officer has had no recent obstetrical experience. Obstetrical experience in general practice is extremely valuable, but should be supplemented by post-graduate training or experience in ante-natal work.

(b) *The Nurse*.—The Medical Officer will require the assistance of a midwife with post-certificate experience in obstetrics and ante-natal work. A second assistant will be required in large clinics for clerical and educational work.

3. *The Patients.*

The patients will include:—

- (1) Those sent by medical practitioners.
- (2) Midwives’ cases.
- (3) Those coming independently.
- (4) Those sent by health visitors.

(a) A patient coming under categories (3) and (4) should be asked what arrangements she has made for her confinement, and if she has not already made any should be advised to do so without delay. Under a following-up scheme it would be possible to ascertain that she does so. If she engages a midwife her ante-natal care would be secured as suggested under the next heading.

(b) *Midwives’ Cases*.—Midwives are obliged under the Central Midwives Board rules to undertake the ante-natal care of their cases, and to keep records, but many of them are unable to do so efficiently, and in assisting and educating them to do so the clinic will find great scope for useful work. If the clinic examinations are made independently of the midwife a double series of examinations is entailed, which is not only worrying to the patient, but leads to the confusion of a double responsibility. Midwives should therefore be encouraged to bring their patients to the clinic and to do their ante-natal work there under supervision, until their knowledge of what is required and their skill in detecting abnormalities are sufficient to enable them to do the routine work in ordinary cases by themselves.

Recently trained midwives may be found able to do this work in all their cases, but even they should be urged to send their cases to a doctor or a clinic for ante-natal examination at least twice during pregnancy.

On booking a case the midwife should ascertain the name of the doctor the patient would wish to employ in case of need during labour, and should inform him of this possibility, and of the ante-natal condition. Forms might suitably be supplied for the purpose by the Local Authority. After the labour

the midwife should be advised to supply the clinic with a report as to the character of the labour, and the Local Authority might pay a small fee for such reports.

(c) *Doctors' Cases.*—If a patient attends a clinic, having already booked a doctor for the confinement, no examination should be made until the doctor has been informed of the patient's wish to attend, and his consent has been obtained. Subsequently reports should be sent to him in every abnormal case, and he in return should be asked to describe the character of the labour.

Any doctor wishing to transfer the whole or part of the ante-natal care of a patient to a clinic should be able to do so. Reports would be sent as before.

4. *Records.*

It is of the greatest importance that records of all ante-natal work should be kept and should be available to any of the trained persons who may from time to time be in charge of an expectant mother. With the patient's consent a written report should be given or sent by the Medical Officer to the doctor or midwife concerned after the preliminary examination has been made, after the special visits, and in all cases of abnormality, whether these are sent by the midwife or doctor or occur in patients already under the care of the clinic. A report of the childbirth should in return be sent to the clinic not only for use in future pregnancies, but also in order that the Medical Officer may check his findings with the actual result.

5. *Co-operation with Hospitals.*

It is hoped that hospitals, both large and small, will be prepared to reserve beds for maternity cases referred to them by clinics or doctors, and that all clinics will work in direct association with one or more hospitals.

As hospitals may find difficulty in providing the ante-natal care for patients living at a distance, it should be possible for them to make arrangements for such patients to attend the nearest clinic during the whole or part of pregnancy as circumstances suggest. In such cases mutual reports would be exchanged.

In all cases presenting difficulty in diagnosis ante-natal consultations with an obstetrician should be possible, either through a clinic or through the patient's own doctor.

6. *Appointments and following up.*

At the first visit to the clinic the woman should be given an appointment card and the date of her next visit booked. If she does not come on that date a note should be sent making another appointment, and if this also fails the health visitor should make a visit to the house. If attendance is not then secured the midwife should be informed of the fact and of her responsibility as to ante-natal care.

7. *Subsidiary Activities.*

The supply of sterilised maternity outfits for labour at cheap rates might properly be undertaken, also the supply at wholesale prices of suitable antiseptics to midwives, etc.

In necessitous cases the provision of food and milk may be desirable.

VI. *Minimum Scope of Ante-natal Examinations.*

A patient should attend first at the 16th week of pregnancy, unless owing to trouble at a previous confinement she has been asked to attend earlier. At this visit a full medical and obstetrical history should be taken, and, if she is prepared, a physical examination should be made. This should include examination of the urine, and an estimation of the blood pressure as a standard for future reference. Dental treatment, if found necessary on examination, should be arranged for. The pelvic measurements should be taken. The question of vaginal examination should be left to the discretion of the Medical Officer, but would always be desirable where there is a discharge or a history of difficult or septic labours. Wasserman reaction should be ascertained where necessary. The breasts should be examined in all cases.

After the examination by the Medical Officer is completed the nurse should enquire into home conditions, give the patient an "Advice Leaflet," and advise her on hygienic matters. Where necessary the home should be visited. The date and hour of the next visit to the clinic should be arranged.

From this time routine examinations should take place either at the clinic or the patient's home as follows:—At the 24th and 28th weeks, from then every fortnight until the 36th week, and thence weekly until she is confined. The uterine height and girth should be taken, the foetal heart listened for, the urine tested, and general enquiries should be made, with special regard to the action of the excretory organs. The midwife should be able to do this examination in most cases at the patient's home, but *any abnormality*, however slight, *must* be brought to the notice of the Medical Officer of the clinic.

In place of, or supplementing, the routine examinations, special examination should be made by the Medical Officer at the 32nd and 36th weeks. These will be directed mainly to ascertaining the presentation of the foetus, and the relation of head to pelvis.

It is advisable that, where possible, the blood pressure should be examined weekly during the last month, as a rise of pressure may be the first sign of a commencing toxæmia.

It is important that the expected date of confinement should be ascertained early in pregnancy, and be confirmed from time to time, and any patient going beyond the 40th week should be referred to the Medical Officer.

If a patient should at any time develop abnormalities rendering her case unsuitable for attendance by a midwife alone, the latter should be informed.

Generally speaking, treatment of abnormal conditions is not the work of an ante-natal clinic. Any cases requiring treatment beyond simple measures should be referred, whenever possible, to the family doctor, or to a consulting clinic, or a hospital.

Finally, the importance of co-operation between the clinic and the professional attendant, as well as the accurate keeping of records, cannot be over-estimated.

Suggestions for Equipment of an Ante-Natal Clinic.

Furniture.

Doctor's Room.

Writing table; chair; patient's chair; examining couch (6 ft. by 2 ft. by 2 ft. 6 ins. high); surgical trolley (16 ins. by 16 ins. by 30 ins.) or enamelled table (for instruments, bowls of disinfectant, etc.); wash hand basin on enamelled stand (where fixture is not available); *cupboard (metal frame, glass front and sides) (instruments); * wall thermometer; fireguard.

Nurses' Room.

Writing table (small); chair; patient's chair; cupboard; wash hand basin on stand (if no fixture); small side table (for sterilizing, urine testing, etc.); * weighing machine; 2nd couch (in large clinics); fireguard; mirror.

Waiting Room.

Chairs; screens (to arrange undressing cubicles); demonstration table (for showing clothing, confinement sets, etc.); blackboard (for health talks); filing cabinet; writing table (small); chair; fireguard; mirror.

Linen, etc.

Nurses' overalls and doctor's gowns (3 of each); dressing gowns (cotton), 12; hand towels, 12; blankets, 2; mackintosh; sheets, 3; pillows, 1; dusters, etc.

Instruments, etc.

Blood pressure apparatus; urine testing apparatus, with litmus and filter papers; pelvimeter; speculum; other instruments (dressing forceps, scissors, etc., tongue depressor and torch, etc.).

Other Equipment.

Chambers; urine glasses, test tubes and stand, etc.; pail, etc.; swab jar, 4 ins. by 4 ins.; kidney trays; bowls; gloves, steriliser; nailbrushes and soap; thermometers; lysol, vaseline, etc.; catheters; inspection light.

* Non-essentials.

APPENDIX G.

Copy of the Death Enquiry Form with Explanatory Note.

Strictly Confidential, for medical use only.**Ministry of Health.—Maternal Mortality Committee.****MATERNAL MORTALITY DUE TO PREGNANCY OR CHILDBIRTH.**

District **Name (initials or number)** **Age** **M.S.W.**
Date of Death **Cause of death as stated on certificate**
Condition of child (alive, still-born, macerated)

Previous Pregnancies (if obtainable)

No.	Year	Term Prem. or Abort.	Complications during			Child	
			Pregnancy	Labour	Puerperium	Living ?	Healthy ?

Last Pregnancy Duration (in weeks)

Occupation, with dates

Housing

No. of children at home

Standard of living (well-to-do, poor, destitute)

Previous illnesses (*e.g.*, Scarlet Fever, erysipelas, tonsilitis)Has patient recently suffered from, or been in contact with infective illness
(*e.g.*, throat, nose, ear, skin, foci of suppuration in pelvis or elsewhere)

General health during pregnancy (including fatigue or overwork)

Ante-natal care from	(1) A.N. Clinic	(2) Doctor	(3) Midwife
No. of consultations			
Examination of Urine and result			

Brief Summary of the Case	Date	Hour	Remarks
At Home Doctor arrived (if engaged) Midwife arrived Doctor arrived (if called) Handywoman In Hospital Time of admission When first seen by Doctor			
Pains began Membranes ruptured { Spontaneous Artificial Os fully dilated Baby born Placenta delivered			

Was there difficulty as to admission to Hospital ?
(e.g., ambulance, bed not available, distance, etc.)

Abortion

Probable cause

Duration of Pregnancy

Date of first symptoms

Treatment

Cause of death

P.M. findings

Toxaemias of Pregnancy

Probable date of conception

Past history of renal disease

Toxaemic symptoms, if any, in earlier pregnancies

Date of appearance and nature of symptoms in pregnancy under inquiry

Date of first and last examination of urine

Date of appearance
of albuminuria

Result

Treatment, if any, for albuminuria—

at home

in hospital

Blood pressure

If raised, when first detected

Fits—ante, intra. or post partum

Number of Date of

Operative interference

Nature and date

Other treatment

P.M. findings

Haemorrhage

Ante-partum (Placenta praevia, accidental) Was doctor immediately

Had patient been told to report bleeding or faintness? (available ?

Had there been previous bleeding during this pregnancy? How was this (treated ?

Treatment

by midwife

by doctor

Was patient removed to hospital?

If not, why?

Condition on arrival at hospital

Treatment in hospital

Post-partum (before or after expulsion of placenta). Probable cause
Treatment
 by midwife
 by doctor
Blood transfusion. Available used
P.M. findings

Difficult labour**Presentation and position**

Disproportion between foetus and pelvis?

Was difficulty anticipated? Steps taken, if any

Operative interference (at home—in hospital)**Forceps**

Indication

Time of application

Condition of cervix

Descent of head in pelvis

Version

Caesarean section—reasons

Other operative treatment, nature

Manual removal of retained placenta or membranes

Anaesthetic or narcotic By whom administered (*i.e.*, a second doctor)

Laceration of genital tract How treated (Duration)

Condition of patient at end of labour P.M. findings

Puerperal Sepsis**Date of Notification** (P.P or P.F.)**Condition of patient at onset of labour****General****Local**

Was there abnormal vaginal discharge?

Treatment before labour?

Disinfection. Precautions during and after labour—antiseptics used.

1. Patient (Preparation of perineum, vulva)

2. Attendant (doctor, midwife, nurse)

Hands gloves gown

Instruments

Were sterile surgical sheets, towels, pads, etc., used?

Sutures

Vaginal examinations Number By whom made

Precautions taken on each occasion.

Complications of Labour**Trauma**—nature and method of treatment**Placenta and membranes** spontaneous—expressed—manual removal
Complete or incomplete

Toilet of patient after labour

Nursing during puerperium including local treatment

Day of onset of fever Signs of local or general infection,

Treat { at home
ment { in hospital

Day of death

Bacteriological findings

Suggested source of infection

P.M. findings

(1) Was there any difficulty in the conduct of the case which in the opinion of the Medical Officer or the attendant might have been prevented by medical or other assistance? (2) Has the Medical Officer or the Medical Attendant any suggestion to offer as to the prevention of the condition which caused death?

Comments by medical investigator.

(1)

(2)

Signature.....

Comments by practitioner in charge of case.

Final Remarks by M.O.H. or Investigator.

Signature.....

Date.....

INVESTIGATION OF MATERNAL DEATHS.

Explanatory Note.

1. In accordance with the directions of the Minister of Health, the Committee on Maternal Mortality have drawn up an Inquiry Form for the investigation of maternal deaths, which they suggest should be circulated to Local Authorities to be used in such inquiries by the Medical Officer of Health either in its present form, or with such modifications as may be considered desirable by individual Authorities. Obviously it will be convenient if the data relating to these deaths are collected in a generally uniform manner, and it is, therefore, hoped that similar arrangements will be made in all parts of the country. It is suggested that investigation into these cases would be facilitated if a copy of the Inquiry Form and of this Explanatory Note were sent to each private practitioner in the district, inviting collaboration in an investigation directed towards improving the maternity service of the country.

2. In order to prevent misconception, it is desirable to state in the first place that all information given on the Inquiry Form will be treated as *strictly confidential*. It will be available only to the Medical Officer of Health himself and to the Ministry of Health, for public health and scientific purposes. Should it be deemed expedient to utilise information obtained in this way for purposes of a report, all names of persons, places, institutions, etc., which might lead to identification will be omitted.

3. The Medical Officer of Health concerned, who should be the Medical Officer of Health of either the Local Supervising Authority, or the maternity and child welfare authority, and should not be engaged in private practice, (see Circular 888), will be responsible for the inquiry which, as far as medical data are concerned, should be conducted by himself either alone or with the assistance of some competent registered medical practitioner. In areas where no recognised obstetric specialist is available to assist the Medical Officer in such inquiries, it may be desirable to invite the local division of the British Medical Association to nominate one or more practitioners whose

services could be requested as and when necessary. The inquiry should always be carried out with the co-operation of the medical practitioner in attendance on the case, and it is perhaps hardly necessary to emphasise the importance of observing the rules of professional courtesy in letter and in spirit. The names of patients or their doctors need not necessarily be included in the reports as submitted to the Ministry, numbers or initials being substituted if preferred.

4. If the patient dies in a hospital or other institution, it is hoped that the authorities of the institution will be willing to furnish all necessary information, but the responsibility for obtaining the history of the case prior to admission to hospital will remain with the Medical Officer of Health.

5. Much of the information asked for on page 1 of the Form will be available already from various sources, and the remainder will usually be obtained at an interview between the general practitioner and the medical investigator. In making such further inquiries as are necessary, due care should be taken to avoid any appearance of criticism of those concerned in the professional conduct of the case. If it be remembered how disturbing to the practitioner is a maternal death in his practice, it will be realised that the attitude should be sympathetic rather than critical.

6. In order to facilitate the investigation of the most common causes of death these are grouped on pages 2 and 3, and there are various questions under each heading which are intended to suggest appropriate lines of inquiry. These groups are not mutually exclusive, and in many cases investigations will fall under more than one heading. Remarks on other conditions may be included on page 1 in connection with the general Summary of the case, or under "Comments" on page 4.

7. It is suggested that if the medical practitioner in charge of the case so desires, the findings of the medical investigator should be shown to him for his observations before the Medical Officer of Health formulates his final report for the Ministry.

GEORGE NEWMAN,
Chairman of Maternal Mortality Committee.

APPENDIX H.

List of Medical Men who Attended Sub-Committees by Invitation of the Committee.

- W. M. Ash, F.R.C.S., Medical Officer of Health, Derbyshire County Council.
Cyril Banks, M.B., B.S., Medical Officer of Health, Nottingham County Borough.
T. Evans, M.B., Medical Officer of Health, Swansea County Borough.
James Fenton, M.D., Medical Officer of Health, Royal Borough of Kensington.
W. E. Henderson, M.B., lately Medical Officer of Health, Westmorland County Council.
Sir T. Eustace Hill, O.B.E., M.B., Medical Officer of Health, Durham County Council.
Oscar M. Holden, M.D., Medical Officer of Health, Croydon County Borough.
R. J. Maule Horne, M.B., Medical Officer of Health, Borough of Poole.
D. Llewelyn Williams, M.C., F.R.C.S., Senior Medical Officer, Ministry of Health, Medical Member of the Welsh Board of Health.
James Young, D.S.O., M.D., F.R.C.S., Gynaecologist, Royal Infirmary, Edinburgh; Physician, Royal Maternity Hospital, Edinburgh.
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APPENDIX J.

List of Bodies and Persons who Submitted Statements of Evidence to the Committee.*Royal College of Physicians of London.*

Sir John Rose Bradford, K.C.M.G., C.B., C.B.E., M.D., P.R.C.P.
J. Prescott Hedley, F.R.C.P., F.R.C.S.

Royal College of Surgeons.

Victor Bonney, M.D., F.R.C.S.
L. Carnac Rivett, M.C., F.R.C.S.

Royal Society of Medicine.

Arthur E. Giles, M.D., F.R.C.S.
J. Montagu Wyatt, F.R.C.S.

British College of Obstetricians and Gynaecologists.

Professor W. Blair Bell, M.D., F.R.C.S. (President).
Eardley L. Holland, M.D., F.R.C.S.

British Medical Association.

H. B. Brackenbury, LL.D., M.R.C.S., L.R.C.P. (Chairman of the Council of the Association).
G. C. Anderson, M.D.
J. W. Bone, M.B.
H. G. Dain, M.B., M.R.C.S.
A. L. Flemming, M.B., M.R.C.S., L.R.C.P.
Sir Ewen J. Maclean, M.D., F.R.C.P.
Christine Murrell, M.D.
Wm. Paterson, M.B.

Medical Women's Federation.

Catherine Chisholm, M.D., Ch.B. (President).
Rhoda H. B. Adamson, M.D., B.S.
Mary H. Frances Ivens-Knowles, C.B.E., M.B., M.S.

Midwives' Institute.

Miss Farrant, Superintendent and Inspector of County Associations of the Queen's Institute.
Mrs. Florence Mitchell, Hon. Secretary, Affiliated Associations Committee.
Miss Fox, practising midwife, Bradford.

Independent Witnesses.

The Right Hon. Lord Riddell.
Sir Henry J. F. Simson, K.C.V.O., M.B., C.M., F.R.C.P.
Comyns Berkeley, M.D., F.R.C.P., F.R.C.S.
Donald W. Roy, M.B., F.R.C.S.
Professor Major Greenwood, F.R.C.P., F.R.S.
H. Harvey Evers, M.S., F.R.C.S.
A. Fulton, M.B., B.Ch., Divisional Medical Officer, Ministry of Health.
W. McKendrick, M.B., B.Ch., Regional Medical Officer, Ministry of Health.
J. Orton, M.D., Regional Medical Officer, Ministry of Health.
Howard E. Collier, M.C., M.B., Ch.B., Redditch.
H. W. Pooler, M.B., B.Ch., Alfreton, Derbyshire.
J. F. Walker, M.B., Southend-on-Sea.

APPENDIX K.

List of Papers Submitted to the Committee.

- British Medical Association: Memorandum Outlining a National Maternity Service Scheme for England and Wales.
- British Medical Association: Report on Causation of Puerperal Morbidity and Mortality.
- Medical Women's Federation: A Scheme for a National Maternity Service.
- The Utilisation of Existing Institutions for a Complete Maternity Service in a County, by W. M. Ash, M.B., F.R.C.S., Medical Officer of Health, Derbyshire County Council.
- Memorandum on the Relief of Pain in Labour without the Use of General Anaesthetics, by S. A. Winstanley, M.B., Ch.B.
- Report on Puerperal Infection in Maternity Hospitals, by A. S. M. Macgregor, O.B.E., M.D., Medical Officer of Health, Glasgow.
- Throat Infections as an Etiological Factor in Puerperal Fever, by W. W. King, M.B. F.R.C.S. (Edin.), Lecturer in Gynaecology and Obstetrics, Sheffield University, Hon. Surgeon, Jessop Hospital for Women, Sheffield.
- Essay on Air-borne Infection in Puerperal Sepsis, by Richard R. Armstrong, M.D., F.R.C.P.
- Studies in Immunity to Haemolytic Streptococci. II. Variations in the ability of broth cultures to withstand the bactericidal power of normal human blood, by Ronald Hare, M.B., B.S. (Lond.).
- Latent Sepsis in Pregnancy Toxaemia, by Frances Ivens-Knowles, M.S., M.B., Ch.M.
- Puerperal Sepsis: An Investigation regarding Contagion and Throat "Carriers" of the Streptococcus Haemolyticus, by E. Farquhar Murray, M.D.
- Observations on Methods of Ante-Natal Care and Midwifery Practice, by Dr. Harold White and Dr. C. V. Pink.
- Maternal Mortality and its Relation to the Shape of the Female Pelvis, by Kathleen Vaughan, M.B.
- Report on Maternal Mortality (being the Quarterly Report to the Maternity and Child Welfare and Midwives Acts Committee of the Radnorshire County Council on January 24th, 1930). Submitted to the Committee by Dr. J. W. Miller, County Medical Officer of Health for Radnor.
- Observations on Maternal Mortality, by Dr. Andrew S. McNeil.
- Memorandum on East Riding Benefit Nursing Association, by The Lady Margaret Bickersteth.
- A Collection of Newspaper Reports on cases of Criminal Abortion, supplied by the Right Hon. Lord Riddell.
- Information as to the conduct of Ante-natal Clinics was placed at the disposal of the Committee in response to their request by the following persons:—
- Dr. W. S. H. Campbell, Medical Officer of Health, County of Lindsey.
- Dr. Dart, Medical Officer of Health, Hackney.
- Dr. H. Evers, Assistant Obstetric Physician, Princess Mary Hospital, Newcastle-on-Tyne.
- Dr. John Fairbairn, Obstetric Physician, St. Thomas's Hospital.
- Miss Alice Gregory, Hon. Secretary, British Hospital for Mothers and Babies, Woolwich.
- Dr. Mary Howie, Senior Child Welfare Officer, Durham County Council.
- Mrs. Keen, Hon. Secretary, North Islington Maternity Centre.
- Dr. E. Lewis Lilley, Obstetric Surgeon, Leicester and Leicestershire Maternity Hospital.
- Professor Louise McIlroy, Obstetrical and Gynaecological Unit, Royal Free Hospital.
- The Secretary, Paddington School for Mothers.
- The Secretary, Queen Charlotte's Hospital.
- Professor B. P. Watson, Sloane Hospital, New York.