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THE ELEMENTS
OF
VITAL STATISTICS.

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THE ELEMENTS
OF
VITAL STATISTICS

BY

ARTHUR NEWSHOLME, M.D., LOND.,

UNIVERSITY SCHOLAR IN MEDICINE; CERTIF. IN PUBLIC HEALTH UNIV. LOND.,
FELLOW OF THE ROYAL STATISTICAL SOCIETY;
MEDICAL OFFICER OF HEALTH FOR BRIGHTON; LATE MEDICAL OFFICER
OF HEALTH FOR CLAPHAM; AUTHOR OF MANUALS OF
"HYGIENE," AND OF "SCHOOL HYGIENE."

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P R E F A C E.

WHEN, some years ago, I first undertook the duties of a Medical Officer of Health, I had considerable difficulty in obtaining trustworthy guidance in the preparation of statistical reports. My researches on the subject revealed the fact that the chief if not the only sources of trustworthy information were the official reports of the Registrar-General and some scattered articles in encyclopædias and in the transactions of learned societies. Further investigation showed that, apart from the reports and articles referred to, a large mass of statistical information was current, which was untrustworthy in its methods of compilation and arrangement, and fallacious in its inferences. It became necessary, therefore, to enter on a somewhat extensive examination of the whole subject; and from the notes gradually accumulated during the years which have since elapsed, I have prepared the present guide to the subject, in the hope that it may be as useful to others as such a guide would have been to me at an earlier stage.

The issue of the selections from the writings of Dr. Farr ("Vital Statistics") by the Sanitary Institute in 1835, which appeared after I had begun my task, did not prevent me continuing it. Every one interested in the progress of public health owes a debt of gratitude to the Sanitary Institute, and to Mr. N. A. Humphreys, the editor of the work, for thus giving in a readily accessible form these selections from Dr. Farr's writings; but the form in which the work is necessarily cast—consisting of extracts from various reports and articles, the subjects of which not infrequently overlap,—although very valuable for reference, does not meet the requirements of the ordinary student.

It is evident that in such a subject the substantive facts must be derived chiefly from the Registrar-General's Reports; and, where it is not otherwise stated, the reader may assume that the facts adduced in the following pages are derived from this source. The value of the Registrar-General's Reports is increasing year by year; and there is no country in the world which possesses so rich a mine of information for all who know how to avail themselves of its treasures.

Other sources of information are acknowledged in their proper place; and the bibliography on pages xix. to xxi. will indicate the chief authorities which have been consulted in its preparation. I am indebted to my

friends, Mr. C. Mansford, B.A., and Mr. W. J. H. Whittall, F.I.A., assistant-actuary to the Clerical, Medical and General Assurance Society, for valuable assistance in the more technical actuarial and mathematical portions of the book.

In conclusion, I venture to hope that this book will be found useful as a guide to junior medical officers of health and to all who are preparing for the various sanitary examinations, whose requirements I have had especially in view in writing it.

ARTHUR NEWSHOLME.

TOWN HALL, BRIGHTON.

March 15th, 1889.

PREFACE TO THE SECOND EDITION.

THE fact that a new edition of this book is required within a few months of its first issue is gratifying, as indicating that it meets the needs of students. The opportunity has been taken to make some verbal corrections; but, with these exceptions, the book remains practically as before.

A. N.

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INTRODUCTION.

VITAL Statistics may be defined as the science of numbers applied to the life-history of communities and nations; and in the following pages the chief statistical facts concerning the various phases and stages of life will be in turn presented. The subject naturally divides itself into two sections: first, the sources of information, as the census enumerations, registration of births, marriages, sickness, death, etc.; and second, the information derived from these sources, which will be discussed in detail in the following pages. (See table of contents, pages ix.-xiii.).

As the scope of a science widens, it is generally found necessary sooner or later to adopt numerical standards of comparison. In medical science this is found to be especially necessary, though perhaps in no other science is the difficulty of exact numerical statement so great. The value of *experience*, founded on an accumulation of individual facts, varies greatly according to the character of the observer. As Dr. Guy has put it: "The *sometimes* of the cautious is the *often* of the sanguine, the *always* of the empiric, and the *never* of the sceptic; while the numbers 1, 10, 100, 10,000, have but one meaning for all mankind."

The variable accuracy of individual observers makes us distrustful of generalities founded on imperfect reasoning or defective facts, and necessitates the use of figures. Experience tells us that a certain event is to be expected, while the numerical method can tell us how often it is to be expected. We shall discuss later on the application of the numerical method to medical problems, and the difficulties involved in it. It is sometimes said *that statistics may be made to prove anything*; and no doubt they may be manipulated in such a manner as to make it difficult to detect the fallacies involved in their abuse. But this ignorant or unscrupulous abuse of figures does not discredit their legitimate use, and that they have a very important and perfectly trustworthy application to medical facts will be abundantly shown in the following pages; while at the same time we hope to effectually guard against the errors which many writers have committed, and so help to rescue the subject from that disrepute into which it has undeservedly fallen.

APPENDIX I.

Occupations of Males and Females in England and Wales at the Census in 1881, arranged in Groups.

| | | Persons engaged in— | Persons. | Males. | Females. |
|--|---|---|------------|------------|------------|
| Class I. Professional. | { | Order 1.—The General or Local Government of the Country . . | 104,592 | 97,222 | 7,370 |
| | | ” 2.—The Defence of the Country | 124,580 | 124,580 | 50 |
| | | ” 3.—Professional Occupations, with their immediate Sub-ordinates | 417,903 | 229,203 | 188,700 |
| Class II. Domestic. | { | ” 4.—Domestic Offices or Services | 1,803,810 | 258,508 | 1,545,302 |
| Class III. Commercial. | { | ” 5.—Commercial Occupations | 816,865 | 308,391 | 8,474 |
| | | ” 6.—Conveyance of Men, Goods, and Messages | 663,263 | 652,270 | 10,993 |
| Class IV. Agricultural. | { | ” 7.—Agriculture | 1,278,624 | 1,214,453 | 64,171 |
| | | ” 8.—Persons engaged about Animals | 104,560 | 103,891 | 669 |
| Class V. Industrial. | { | Persons working and dealing in— | | | |
| | | ” 9.—Books, Prints, and Maps | 105,042 | 89,130 | 15,912 |
| | | ” 10.—Machines and Implements | 267,976 | 253,994 | 13,982 |
| | | ” 11.—Houses, Furniture, and Decorations | 786,660 | 768,283 | 18,377 |
| | | ” 12.—Carriages and Harness | 87,174 | 84,692 | 2,482 |
| | | ” 13.—Ships and Boats | 54,080 | 53,967 | 113 |
| | | ” 14.—Chemicals and Compounds | 43,015 | 38,597 | 4,418 |
| | | ” 15.—Tobacco and Pipes | 22,175 | 12,862 | 9,313 |
| | | ” 16.—Food and Lodgings | 629,371 | 503,344 | 126,027 |
| | | ” 17.—Textile Fabrics | 1,053,648 | 463,024 | 590,624 |
| | | ” 18.—Dress | 981,105 | 364,680 | 616,425 |
| | | ” 19.—Various Animal Substances | 68,202 | 53,564 | 14,638 |
| | | ” 20.—Various Vegetable Substances | 166,745 | 130,580 | 36,165 |
| | | ” 21.—Various Mineral Substances | 1,277,592 | 1,212,491 | 65,101 |
| Class VI. Indefinite and Non-Productive. | { | ” 22.—General or Unspecified Commodities | 816,243 | 753,285 | 62,958 |
| | | ” 23.—Refuse Matters | 14,339 | 12,685 | 1,654 |
| | | ” 24.—Persons without Specified Occupations | 14,786,875 | 4,856,256 | 9,930,619 |
| Total | | | 25,974,439 | 12,639,902 | 13,334,537 |

APPENDIX II.

Mortality and Sickness Experience of the Ancient Order of Foresters Friendly Society for the Five Years, 1871-75
—Males (Neison).

| Ages. | RURAL DISTRICTS. | | | TOWN DISTRICTS. | | |
|---------------|------------------------------------|------------------------------|---|------------------------------------|------------------------------|---|
| | Number of Members Exposed to Risk. | Annual Death-Rate per 1,000. | Sickness (in Weeks) per Member per Annum. | Number of Members Exposed to Risk. | Annual Death-Rate per 1,000. | Sickness (in Weeks) per Member per Annum. |
| 18- | 5268 | 7.40 | .926 | 2795 | 11.09 | 1.080 |
| 20- | 73565.5 | 6.70 | .799 | 52521 | 7.29 | .833 |
| 25- | 165420.5 | 7.07 | .868 | 151314.5 | 7.88 | .933 |
| 35- | 105232.5 | 9.54 | 1.123 | 104893.5 | 11.80 | 1.227 |
| 45- | 46675.5 | 14.44 | 1.584 | 45960.5 | 17.38 | 1.950 |
| 55- | 17968. | 28.16 | 8.222 | 16270.5 | 83.44 | 8.817 |
| 65- | 6872.5 | 61.11 | 8.640 | 5215 | 66.92 | 10.565 |
| 75- | 771.5 | 129.62 | 17.525 | 488 | 168.03 | 21.516 |
| 85- | 14 | 214.28 | 22.551 | 30 | 66.67 | 16.800 |
| 95- | 5 | — | 6.771 | 85 | 114.29 | 22.008 |
| Totals | 421793. | 10.45 | 1.258 | 379523 | 12.04 | 1.410 |
| | CITY DISTRICTS. | | | ALL DISTRICTS COMBINED. | | |
| 18- | 2179 | 11.93 | 1.251 | 10242 | 9.87 | 1.037 |
| 20- | 55525.0 | 8.52 | .833 | 181612 | 7.43 | .819 |
| 25- | 201468.5 | 9.03 | .927 | 518203.5 | 8.07 | .910 |
| 35- | 153200 | 13.56 | 1.842 | 863326 | 11.74 | 1.245 |
| 45- | 63673.5 | 21.09 | 2.130 | 156309.5 | 18.02 | 1.914 |
| 55- | 19781 | 36.65 | 4.127 | 54019.5 | 82.86 | 8.732 |
| 65- | 4702.5 | 68.90 | 8.558 | 16790 | 65.10 | 9.215 |
| 75- | 303 | 148.51 | 14.352 | 1562.5 | 145.28 | 18.157 |
| 85- | 17 | 117.65 | 5.386 | 61 | 114.75 | 14.939 |
| 95- | — | — | — | 40 | 100.00 | 20.103 |
| Totals | 703195. | 13.65 | 1.404 | 1302166 | 12.14 | 1.358 |

APPENDIX III.

Sickness Statistics of the Hearts of Oak Benefit Society for 1886.

| Ages. | Number of Members Sick out of each 100 Exposed to Risk. | | | | Average Sickness per Member Exposed to Risk (Weeks). | | | | Average Duration of Sickness per Member Sick (Weeks). | | | |
|----------|--|---------------------------------|-------------------|-------------------|---|---------------------------------|-------------------|-------------------|--|---------------------------------|-------------------|-------------------|
| | Full Pay. | | | Half Pay. | Full Pay. | | | Half Pay. | Full Pay. | | | Half Pay. |
| | Total Country Districts. | Metro- politan Districts. | All Districts. | All Districts. | Total Country Districts. | Metro- politan Districts. | All Districts. | All Districts. | Total Country Districts. | Metro- politan Districts. | All Districts. | All Districts. |
| 15-20 | 15.01 | 13.29 | 14.22 | — | .51 | .46 | .49 | — | 8.41 | 3.45 | 3.43 | — |
| 20-25 | 21.87 | 16.07 | 19.22 | .32 | .81 | .60 | .70 | .03 | 8.70 | 3.72 | 3.71 | 8.79 |
| 25-30 | 21.66 | 17.90 | 19.92 | .47 | .86 | .63 | .75 | .05 | 8.95 | 3.50 | 3.76 | 10.53 |
| 30-35 | 23.53 | 20.58 | 22.03 | .69 | 1.02 | .84 | .93 | .07 | 4.83 | 4.09 | 4.22 | 10.80 |
| 35-40 | 24.14 | 21.65 | 22.66 | 1.06 | 1.14 | 1.03 | 1.07 | .11 | 4.70 | 4.75 | 4.74 | 10.58 |
| 40-45 | 25.65 | 24.13 | 24.71 | 1.39 | 1.33 | 1.19 | 1.24 | .16 | 5.17 | 4.93 | 5.02 | 11.84 |
| 45-50 | 29.09 | 26.29 | 27.47 | 1.58 | 1.53 | 1.54 | 1.53 | .18 | 5.25 | 5.84 | 5.58 | 11.11 |
| 50-55 | 31.81 | 30.41 | 31.12 | 3.04 | 2.11 | 1.91 | 2.01 | .32 | 6.62 | 6.29 | 6.46 | 10.65 |
| 55-60 | 32.99 | 36.22 | 34.53 | 3.80 | 2.33 | 2.56 | 2.44 | .43 | 7.07 | 7.05 | 7.07 | 11.40 |
| 60-65 | 37.57 | 38.82 | 38.16 | 6.94 | 3.18 | 3.23 | 3.21 | .95 | 8.47 | 8.34 | 8.41 | 13.69 |
| 65-70 | 34.75 | 34.56 | 34.68 | 6.28 | 2.92 | 3.89 | 3.31 | .68 | 8.39 | 11.24 | 9.54 | 10.86 |
| 70-75 | 29.85 | 41.67 | 35.97 | 10.07 | 4.19 | 4.51 | 4.36 | .80 | 14.03 | 10.83 | 12.12 | 7.96 |
| 75-80 | — | 33.33 | 14.29 | — | — | 1.27 | .55 | — | — | 3.80 | 3.80 | — |
| All Ages | 24.12 | 21.59 | 22.77 | 1.01 | 1.12 | 1.01 | 1.06 | .11 | 4.65 | 4.65 | 4.65 | 10.96 |

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