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## SOMMAIRE :

For translation, see corresponding page of back cover

### ETUDES ECONOMIQUES ET JURIDIQUES

PAGE

M. R. EL-SHANAWANY.—The First National Life Tables for Egypt 200-260

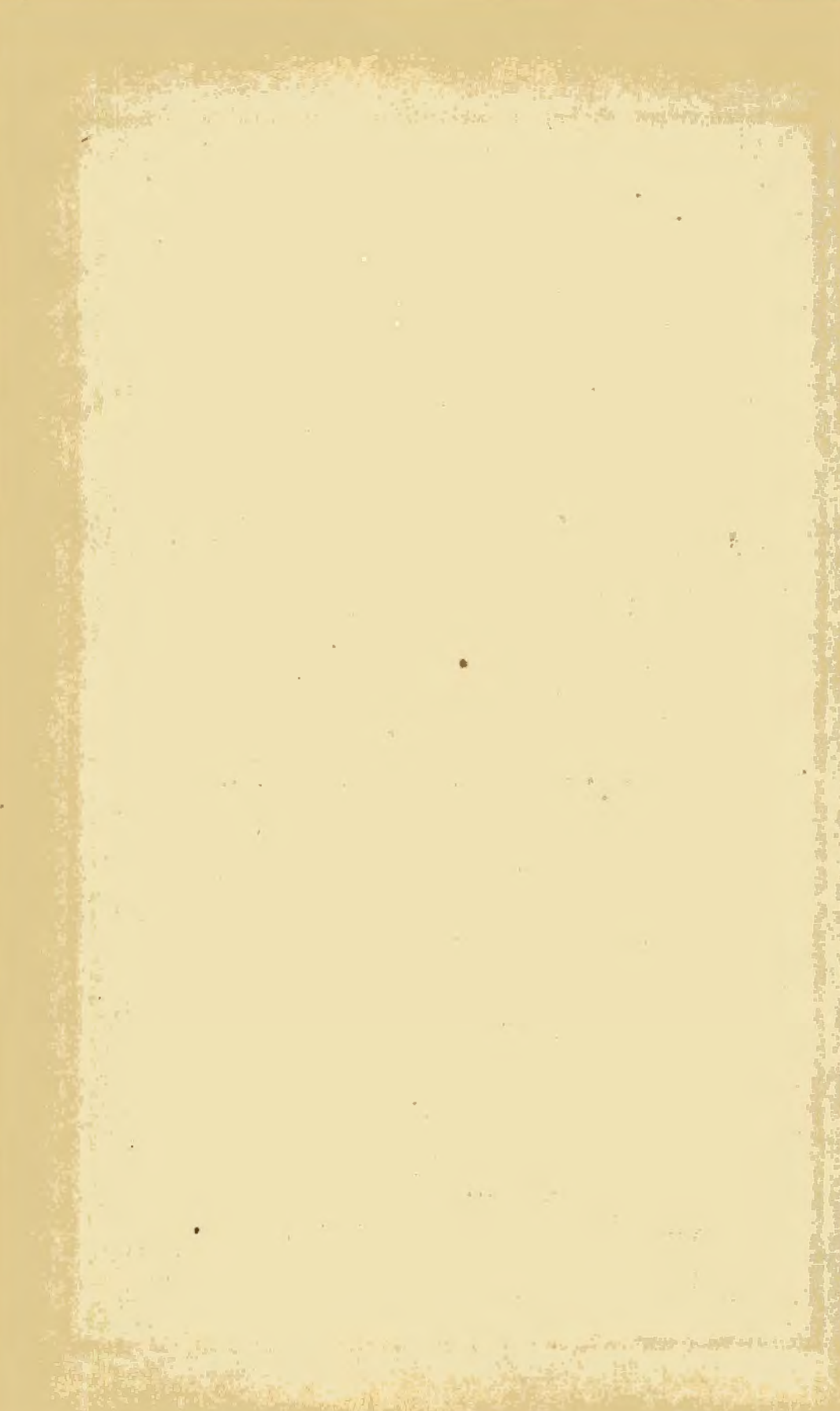
# THE FIRST NATIONAL LIFE TABLES FOR EGYPT

BY

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1936



## NÉCROLOGIE

### YEHIA IBRAHIM PACHA

C'est avec une profonde douleur partagée par toutes les classes de la population que l'Égypte apprit le matin du 23 mars la mort d'un de ses enfants les plus illustres et les plus aimés, YEHYA IBRAHIM PACHA, plusieurs fois président du Conseil des Ministres, ancien président du Sénat, titulaire des plus Hautes distinctions égyptiennes et étrangères.

Sa longue carrière de magistrat—dans laquelle il débuta en 1888 et dont il atteignit le plus haut grade, celui de président de la Cour d'Appel indigène qu'il occupa pendant treize ans—développa à l'extrême les qualités d'un humanisme exquis dont la nature l'avait généreusement doté.

Sa parfaite connaissance des hommes et des choses de son pays qu'il aimait ardemment, et avec une claire vision de ses possibilités et des intérêts réels, son profond sentiment du devoir, sa droiture absolue, son désir de servir, sa bonté sans bornes, sa fidélité envers ses amis et son indulgence à l'égard de ses adversaires, la modestie et la simplicité dont il ne s'est jamais départi même lorsqu'il atteignit le faite des grandeurs et des honneurs, avaient fait de lui une des plus belles, des plus attachantes figures de l'Égypte contemporaine dont il fut un des meilleurs artisans.

Ces qualités lui valurent la confiance absolue du Souverain qui, connaissant son désintéressement et sa loyauté indéfectibles, recherchait ses conseils et ses services aux heures les plus difficiles que le pays a traversées depuis l'année 1922.

C'est, en effet, au lendemain de la déclaration de l'Indépendance de l'Égypte, en 1922, que Yéhia Ibrahim Pacha, par pur patriotisme et non par ambition, entra dans la politique où il joua d'emblée un rôle de premier plan grâce à son esprit de conciliation, de modération et de clair-voyance et au fait qu'il a toujours mis son pouvoir au service de la justice.

Son rôle terminé, il rentrait silencieusement et avec joie dans sa famille très unie dont il avait le culte et qui était la source où il puisait ses plus grandes satisfactions.

La Société Royale d'Economie Politique, de Statistique et de Législation, dont il était le vice-président depuis le 19 avril 1917, a perdu en la personne révéree de YEHIA IBRAHIM PACHA, un de ses membres de la toute première heure, un ami fidèle, un précieux conseiller et collaborateur.

Nous nous inclinons respectueusement devant sa tombe. Que sa famille éplorée veuille trouver ici l'expression de notre sympathie émue et de notre fidèle et reconnaissant souvenir.

LA RÉDACTION



## PREFATORY NOTE

M. R. El-Shanawany Effendi has asked me to write an introduction to his study of the first mortality table for Egypt, and I gladly comply, in view of the importance of the subject.

He has drawn attention to two short-comings of Egyptian vital statistics: (1) the existence of actual errors in the recorded figures of births and deaths and (2) the errors in the statement of age in death registration and in Census returns. I can confirm his remarks. Shortly after the figures of the 1927 Census became available I began, together with Badie Effendi Hanna, to attack the problem which El-Shanawany Effendi has solved, namely the investigation of life-tables for male and female lives. It was soon evident that the usual method was not applicable, namely that of referring the deaths at each age, which have occurred over an interval extending equally in each direction from the Census date, to the population of that age enumerated in the Census, because no reliance could be placed on the recorded deaths. I have since then gone more fully into the errors of registration, and hope to publish my results soon, but my conclusions are, in brief,

1. that records of deaths in the towns have been fairly reliable; but
2. that such records in the country districts have been much less so, and have been quite unreliable as regards deaths of females.

These conclusions were the result of several converging lines of argument, none of which depended at all on Census figures, and I think there is no escaping the facts. The figures bear in themselves evidence of their own inaccuracy. Incidentally, this conclusion disposes of a criticism of the Census figures, that they were "obviously untrustworthy because they do not accord with the vital statistics."

The usual method of compiling a life-table not being applicable, I was forced to adopt that employed by El-Shanawany Effendi, which is to compare age-groups in the 1927 Census with the corresponding age-groups (very closely 10 years younger) in the 1917 Census. But my procedure differed from his in that I smoothed the very rugged age-distributions by a graphical process, combined with an arithmetical adjustment of the differences, whereas El-Shanawany Effendi has smoothed by the use of one of Professor Karl Pearson's frequency curves.

His justification for the use of a frequency curve must lie in its *ex post facto* success in representing the statistics, rather than on any *a priori* grounds. Actually I was engaged in the attempt to fit to the crude age-groups an expression consisting of the sum of exponential terms of the form  $\Sigma A_k \exp. (a_k x)$ , where  $x$  was the age, and the coefficients  $A_k$  and  $a_k$  might be real or complex. I hoped that the complex parts would be found to arise from the periodicity of the age mis-statements, and that, by ignoring their imaginary parts, there would result a smoothed expression of the age, from which the mis-statements had been eliminated. A technique was elaborated, and the arithmetical work, which was heavy, carried out, but the result was so absurd that it was clear that some error had crept into the arithmetic. Pending its investigation, the work was stopped and not even the graphical figures were used.

So to El-Shanawany Effendi belongs the credit of having carried through the very heavy calculations that such a research necessitates and of having produced the first life-tables for the population of Egypt. Of the importance of such work there can be no question and he is to be congratulated on what he has done.

J. I. CRAIG.

*Cairo, March 15, 1936.*

**P.S.**—I have judged it advisable to leave the letterpress exactly as written by the author.

## I.—Introductory

No attempt has yet been made in Egypt to investigate the age - distribution and the rates of mortality of the male and female populations, as disclosed by the various General Censuses carried out in the country since 1882.

This may be attributed to the scantiness of the raw material necessary for the investigation and the unreliability of the returns in the earlier censuses.

Since a comparison of the duration of successive generations in Egypt and other countries will throw much light on the physical condition of the population, and suggest to scientific and philanthropic individuals—and to the Government—many ways of diminishing the sufferings and ameliorating the health and condition of the people, I felt it very desirable to try to investigate the age -distributions and the rates of mortality of the male and female populations of Egypt as a whole, as recorded by the censuses of 1917 and 1927. I hope—in another paper—to be able to pursue this subject further and to exhibit the difference which prevails in each of the fourteen provinces which constitute the Kingdom.

Before proceeding to the theme of the present paper it may be useful to give a brief review of the previous censuses and to state the main difficulties which I have faced in my investigation of the 1917 and 1927 figures.

The first systematic attempt to ascertain the population of Egypt was made in 1882, but it was beset with the usual difficulties attending a pioneer census, and the population of 6,804,021 shown by the returns was considerably less than the actual number, and therefore it is impossible to regard the results as sufficiently accurate to furnish a basis for comparison. In 1897 the first reliable census was carried out and there was an increase of 2,910,504 persons, a substantial share of which was fictitious and due to improved enumeration. Between the Census of 1897 and that of the ensuing Census of 1907, the recorded population increased by 16.2 per cent, a fact which shows a progressive improvement in the organisation of the census operations.

In the last two Censuses of 1917 and 1927, which are the fundamental basis of the present research, no trace of systematic resistance to inquiry has been found, and as far as the number of living is concerned, there was no serious omission in the returns of the two censuses. The general arrangements in the two censuses were nearly identical. The census taking was divided into two periods so far as the illiterate population was concerned: a preliminary census was taken by the enumerators, nearly two weeks before its final revision. The literate portion of the population themselves filled in details of the composition of the household at midnight between the day of the final revision and that preceding it. Therefore, there is no prior reason to suspect any omissions from the returns; and we may confidently assert that the standard of accuracy in the enumeration was exceptionally high, for the various steps in the organisation are now familiar to the people and accepted by them, usually without resentment and often with considerable interest. In spite of this, there still remains a fundamental difficulty arising in connection with the Census records, namely the mis-statement of age. This difficulty will be dealt with fully later on, and the method which has been adopted for adjusting these age records illustrated. Unfortunately another serious difficulty arises in respect of defective registration of births and deaths and the inaccuracies in the statement of ages of the deceased. These deficiencies of the birth and death registration records, as will be seen later, are the main difficulties which cannot be avoided; facing them I thought I should have to depart entirely from the usual method of calculating National Life-Table, *i.e.* dealing with the figures of two successive decennial censuses, together with the number of births and deaths for each of the intervening ten years.

## II.—The Deficiencies of Births and Deaths Registration

Although the registers of births and deaths in Egypt showed great improvement since the last amendment to the Registration Law of Births and Deaths of 1912, yet they still contain many inaccuracies and are still incomplete.

This may be fully grasped by comparing the populations ascertained at the Censuses with those calculated on the basis of the returns of births and deaths and published in the Official Publications of the Statistical

Department, Cairo. Table I. shows the populations of Egypt as disclosed by the five Censuses, together with the mid-year estimated population of the last three Censuses according to Vital Statistics. The mid-year estimated population of the two earliest Censuses of 1882 and 1897 were carried out by the Public Health Department, but no Official records for these two estimations seem to exist.

TABLE I.

| Date of Census        | Population<br>according<br>to Census | Population<br>according to<br>Vital Statistics | Difference |
|-----------------------|--------------------------------------|------------------------------------------------|------------|
| May 3, 1882 ... ..    | 6,804,021                            | —                                              | —          |
| June 1, 1897 ... ..   | 9,714,525                            | —                                              | —          |
| April 29, 1907 ... .. | 11,287,359                           | 11,150,559                                     | 136,800    |
| March 7, 1917 ... ..  | 12,750,918                           | 12,338,000                                     | 412,918    |
| Febr. 19, 1927 ... .. | 14,217,864                           | 14,688,700                                     | —470,836   |

It can be easily seen from the Table that there is a notable difference between the two populations. According to the Vital Statistics, the births exceeded the deaths during the last decade by 1,937,782 persons, while the census disclosed an increase of 1,466,946 persons; in other words, the census returns showed about half a million less than the estimated population of 1927. It seems probable that a number larger than half a million deaths escaped registration. On the other hand, the Vital Statistics estimations of the population in 1917 and 1907, were less than the corresponding figures disclosed by the Censuses of 1917 and 1907. A fact which indicates that before the amendment to the Registration Law of Births and Deaths of 1912, the reporting of births was less complete than that of deaths, —a condition similar to that prevailing now in India. In 1917, the Vital Statistics estimation exceeded the Census figure by about half a million persons, while in 1907 it exceeded the Census figure by about one-fifth of a million persons. Therefore, it is clear that little reliance can be placed on the birth and death returns and it is impossible in the present state of Vital Statistics, which have only recently attained a fair degree of accuracy, to take its scanty data as a basis for calculating Life-Tables. In addition to this incomplete registration of births and deaths, the statement of age at

death is extremely rough and crude and in the majority of cases is a matter of guess work, which may differ by 10 or 20 years --or even more-- from the true age of the deceased, a matter which gives rise to hesitation and diffidence. Facing the difficulties mentioned above, it seemed essential to depart entirely from the general rule of calculating a Life-Table ; it was necessary to find some other way quite independent of the birth and death returns. It is to be hoped that, in the future, efforts will be concentrated on insuring accurate registration of births and deaths and securing more reliable information of age at death in order that Life-Tables may be deduced with greater reliability.

### III.—The Data required for the Construction of the Present Life-Tables

The Census of 1917 disclosed a population of 12,750,918, as compared with 14,217,864 at the Census taken on February 19, 1927. The increase in the population is almost entirely the result of its natural growth during a period free from destructive epidemics—except in 1918—when an influenza epidemic spread all over the country and caused the natural increase, (births-deaths) to be a small negative quantity, in other words, deaths slightly exceeded births. Also it was a period of considerable agricultural prosperity. Although we have no means, at present, of gauging the net result of migration, it is likely to be very small. Emigration of the natives is almost non-existent, while the net result of migration among the foreigners is practically nil, since the number of foreigners disclosed by the two Censuses of 1917 and 1927 was almost the same and amounted to about 225,000 persons. Therefore, during the decade 1917–1927, the Egyptian population may be regarded as a community which had been undisturbed by emigration or immigration. Moreover, it can be seen from the minority of foreigners, that the Egyptian population, on which the present investigation is made, included an overwhelming proportion of native lives and may be considered, for all practical purposes, as consisting entirely of native Egyptians. Bearing this in mind I decided to construct the present Life-Tables, using only data from Censuses of 1917 and 1927 and to abandon entirely the use of any other data concerning births and deaths or the age-distribution of deaths in the intervening years. Thus, the following data only will be used for calculating the present Life-Tables.

(1) The age-distribution according to Census Returns of 1927 for each sex.

(2) The age-distribution according to Census Returns of 1917 for each sex.

The summary figures of these two Censuses are given in Table 2. The enumerated populations with discrimination of sex, in 1917 and 1927, are given in rows (1) and (2); while the actual and percentage variations of the populations are given in rows (3) and (4).

TABLE 2.

|                          | Total      | Males     | Females   |
|--------------------------|------------|-----------|-----------|
| (1) Population 1927 ...  | 14,177,867 | 7,058,073 | 7,119,794 |
| (2) Population 1917 ...  | 12,718,255 | 6,369,517 | 6,348,738 |
| (3) Actual Variation ... | 1,459,612  | 688,556   | 771,056   |
| (4) Per cent ... ..      | 11·5       | 10·8      | 12·1      |

It should be noted that these figures do not include the Bedouins, while those in Table 1, contain an estimated number of them. I have excluded them from my data because any information as to their number is wholly inaccurate, while their age-distribution is not given at all.

The age-distribution for the males and the females as published for the 1927 Census is given by annual age-periods up to 5, and then for quinquennial periods up to 100, the last group being 100 and over; while for the 1917 Census the distributions are given for each year of life up to 5, for quinquennial periods up to 30, and then for decennial periods up to 100, the last group again being 100 and over. The un-stated-age population in 1917 amounted to 40,417, out of whom 14,990 were females and the remainder 25,427 were males. In 1927 Census, the number of persons who did not state their age amounted to 39,397; out of whom 18,325 were males, and 21,072 were females.

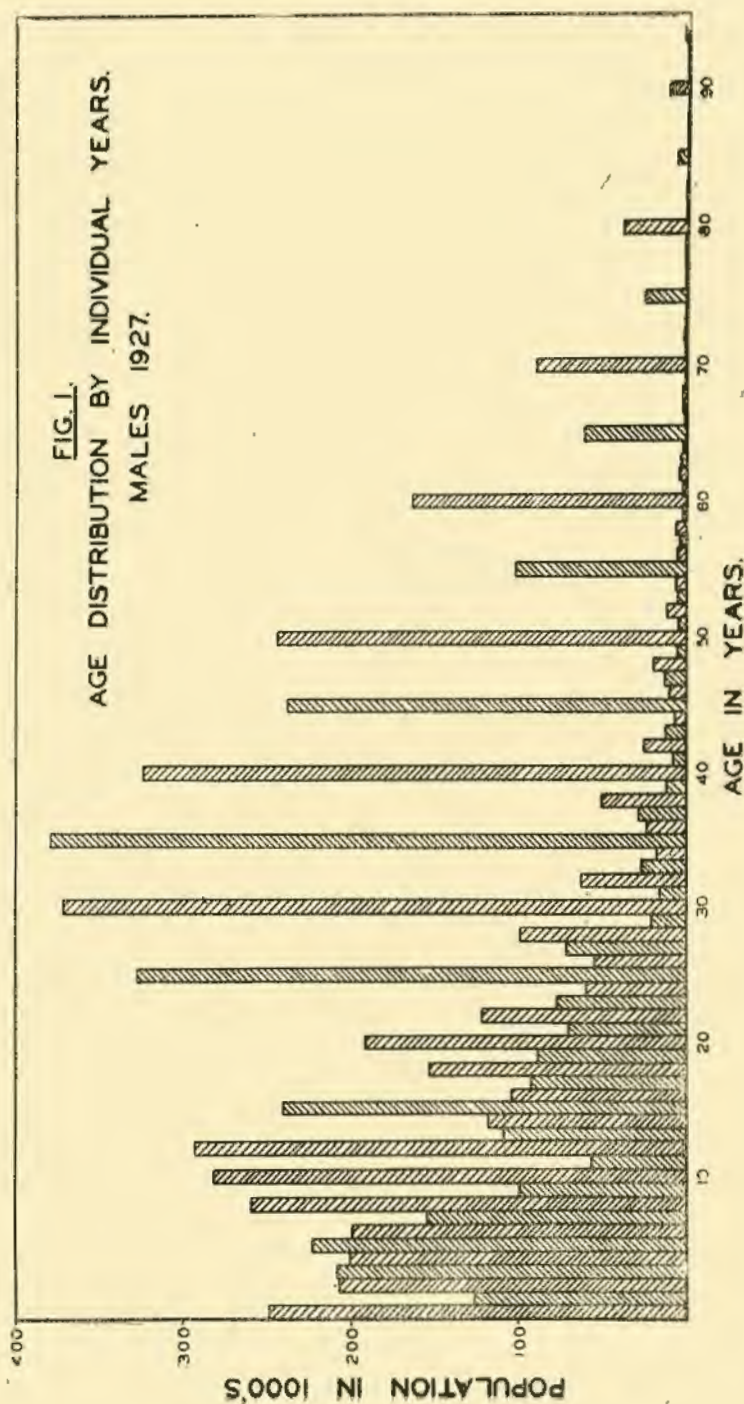
One of the fundamental difficulties arising in connection with the two Census figures is the inaccuracy of the statement of age. These entries are most unreliable, partly owing to ignorance, partly to carelessness and partly to deliberate mis-statement. It is impossible to determine

with any accuracy to what extent these different factors contributed to the irregularities in the age-distribution ; but we may confidently say — owing to the fact that the great bulk of the population is illiterate — that ignorance is the prominent factor responsible for a great deal of the irregularities, while deliberate mis-statement of age occurs only in certain age-group which differ according to sex. In the female distribution the age-group 10-20, as will be seen from the graduated age-distribution given below, seems to be the favourite group for the misstatement of age ; while the age-group 20-30 is the favourite for males. An explanation of this, which I believe may be sound, will be given later when the misstatement of age is dealt with.

In order to give a clear idea of the extent of the irregularities and anomalies in the age-distribution, I have, fortunately, at my disposal the male and female age-distribution for each year, as disclosed by the Census of 1927. These two distributions have not yet been published anywhere, but I have made use of them in an Official Report upon some other investigation. They are shown in Table 3, and to convey the general idea of the great fluctuation in both age-distributions, the figures are presented in graphic form in Diagrams (1) and (2).

I do not propose, at this stage, to comment on this Table, beyond pointing out the tendency of individuals to choose ages ending with 0 or 5, and a glance, even at the Table shows the great irregularities of the distribution and indicates that it is entirely unreliable, and that such distribution, as it stands, tells us virtually nothing. It would be of great interest to compare the age-distribution of the population by individual years, as stated in the 1927 Census, with that given in 1917 to see the degree of progress and improvement in the statement of age, but unfortunately in 1917 such a distribution was not published and cannot even be traced.

In spite of the awkward irregularities of the distribution, a fair approximation of the actual facts can be deduced from it by grouping the date in quinquennial or preferably in decennial age-groups, for when we deal with large numbers, the errors due to under and over statement of age tend to cancel one another, while the effects of choosing favourite numbers can be eliminated by a careful process of smoothing.



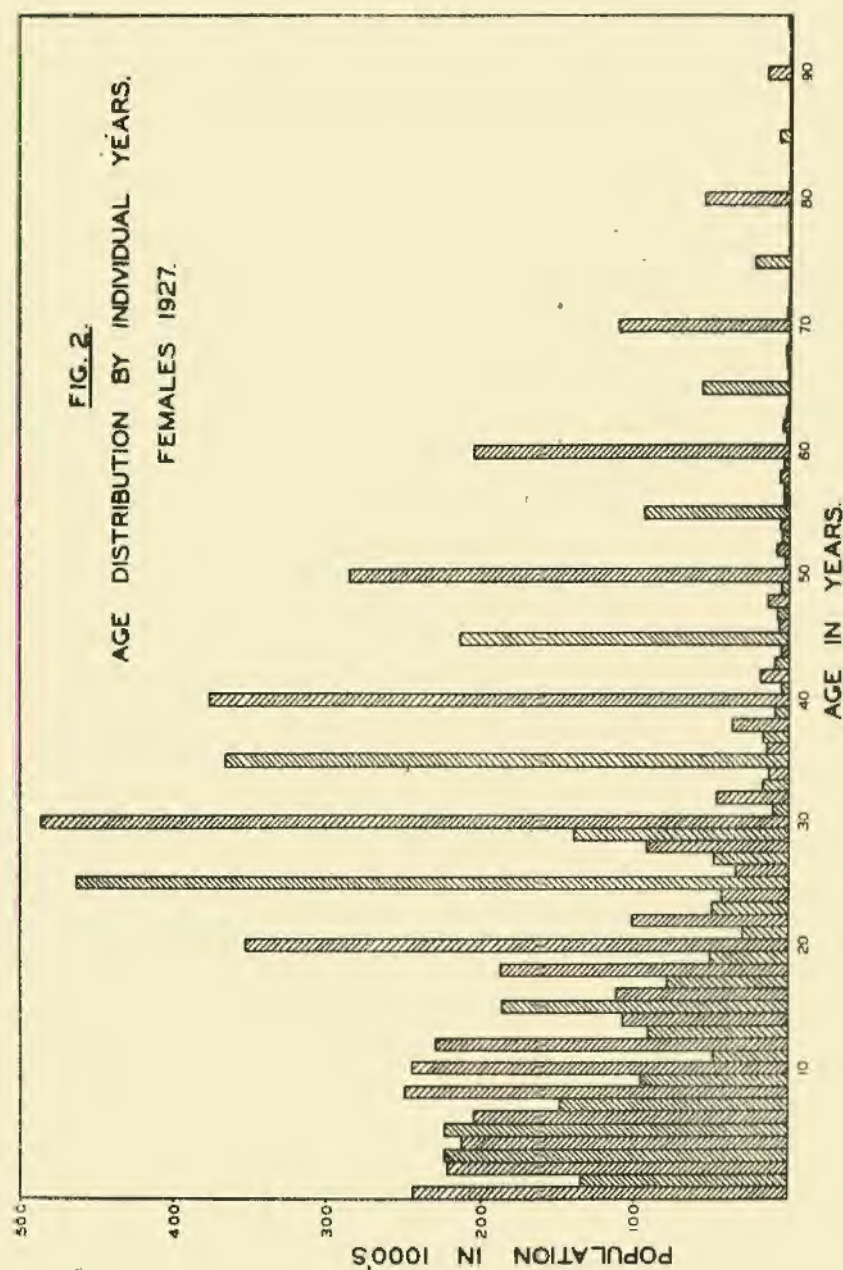


TABLE 3.—MALE AND FEMALE POPULATIONS, AS ENUMERATED AT EACH AGE FROM 1927 CENSUS SCHEDULES.

| Age | Males   | Females | Age | Males   | Females | Age | Males   | Females | Age | Males  | Males  |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|-----|--------|--------|
| 0   | 249,166 | 243,785 | 24  | 59,365  | 43,824  | 48  | 19,704  | 13,754  | 72  | 1,784  | 1,539  |
| 1   | 127,462 | 135,141 | 25  | 327,921 | 463,728 | 49  | 5,395   | 4,184   | 73  | 827    | 675    |
| 2   | 207,314 | 211,127 | 26  | 54,506  | 34,572  | 50  | 243,172 | 285,369 | 74  | 493    | 360    |
| 3   | 208,750 | 223,729 | 27  | 71,969  | 48,980  | 51  | 4,058   | 2,685   | 75  | 24,829 | 22,972 |
| 4   | 201,769 | 212,452 | 28  | 98,688  | 91,362  | 52  | 11,167  | 7,403   | 76  | 522    | 403    |
| 5   | 223,041 | 223,627 | 29  | 20,461  | 13,983  | 53  | 5,738   | 3,611   | 77  | 475    | 357    |
| 6   | 199,518 | 204,155 | 30  | 372,407 | 486,263 | 54  | 6,433   | 4,008   | 78  | 655    | 565    |
| 7   | 155,490 | 149,360 | 31  | 15,990  | 9,444   | 55  | 101,446 | 93,666  | 79  | 305    | 305    |
| 8   | 260,167 | 249,240 | 32  | 62,083  | 46,657  | 56  | 5,015   | 2,915   | 80  | 38,228 | 55,668 |
| 9   | 99,217  | 95,576  | 33  | 26,074  | 16,169  | 57  | 4,989   | 2,972   | 81  | 282    | 315    |
| 10  | 282,276 | 244,564 | 34  | 17,775  | 12,528  | 58  | 6,930   | 5,038   | 82  | 503    | 494    |
| 11  | 56,475  | 48,550  | 35  | 379,499 | 366,906 | 59  | 2,183   | 1,821   | 83  | 241    | 200    |
| 12  | 293,741 | 228,600 | 36  | 23,270  | 13,789  | 60  | 165,007 | 204,810 | 84  | 195    | 157    |
| 13  | 109,367 | 90,310  | 37  | 28,721  | 16,967  | 61  | 1,954   | 1,354   | 85  | 6,872  | 7,042  |
| 14  | 118,624 | 107,371 | 38  | 50,196  | 36,685  | 62  | 4,912   | 3,474   | 86  | 163    | 124    |
| 15  | 240,093 | 186,107 | 39  | 11,686  | 8,114   | 63  | 3,373   | 2,128   | 87  | 222    | 189    |
| 16  | 104,937 | 111,940 | 40  | 324,856 | 376,340 | 64  | 2,091   | 1,332   | 88  | 136    | 142    |
| 17  | 92,400  | 78,390  | 41  | 7,561   | 4,750   | 65  | 60,661  | 56,268  | 89  | 93     | 101    |
| 18  | 154,598 | 187,412 | 42  | 25,825  | 17,552  | 66  | 1,436   | 854     | 90  | 11,662 | 15,427 |
| 19  | 88,085  | 50,879  | 43  | 12,950  | 8,872   | 67  | 2,118   | 1,428   | 91  | 81     | 87     |
| 20  | 192,208 | 353,290 | 44  | 6,773   | 4,065   | 68  | 2,333   | 1,969   | 92  | 128    | 126    |
| 21  | 70,882  | 29,100  | 45  | 237,009 | 213,491 | 69  | 762     | 716     | 93  | 61     | 67     |
| 22  | 122,554 | 101,452 | 46  | 9,930   | 5,020   | 70  | 89,766  | 110,158 | 94  | 42     | 29     |
| 23  | 77,748  | 49,600  | 47  | 11,931  | 6,423   | 71  | 754     | 699     | 95  | 2,281  | 2,192  |

#### IV.—Graduation of Male and Female Age-Distributions of 1917 and 1927 Census Figures

It would occupy too much space to state in details the whole process and calculation involved in fitting the four appropriate Pearsonian Curves to the male and female populations of 1917 and 1927. The main steps of graduation are presented in the Appendix, and it will suffice here to give a brief summary of the situation. The male and female figures of 1927 have been grouped in quinquennial age-groups 0-4, 5-10, ..... etc.; and then the nonstated number of each sex has been distributed proportionally over the several periods of life. Having adjusted the age groups according to the appropriate number of individuals whose ages are not stated, the first four moments,  $\nu_1$ ,  $\nu_2$ ,  $\nu_3$ , and  $\nu_4$ , about a working origin are calculated and corrected for abruptness, and consequently the values of  $\beta_1$  and  $\beta_2$ . It has been found that the appropriate frequency curves of the male and female distributions of 1927 are Pearsonian Type IX-Curves.

$$y = y_0 \frac{\lambda}{(a-x)}$$

where  $y$  and  $\lambda$  are constants to be determined from the data; and the age at which all individuals vanish is  $x=ka$ , where  $k$  is the unit of grouping, and equal to 5 years in the case of 1927 data. Unfortunately the figures of 1917 cannot be grouped in quinquennial age-groups, for, as mentioned before, the official figures of these two distributions are not given in quinquennial age-groups up to the end of the life. Therefore the only alternative is to adopt decennial age-groups in this case. Moreover, in dealing with these data I faced another difficulty owing to the lack of information concerning the five sub-groups of the first age-group 0-10, i.e. the number of lives whose ages lie between 0-2, 2-4, 4-6, 6-8, and 8-10; the result of this is that we cannot apply the Abruptness or even Shepherd's Corrections to the moments, for in such a case, instead of improving the result, they make it worse. The two frequency curves which have been fitted to the distributions are still Type IX.

It is rather interesting to see the effect of decennial grouping and non-corrected moments, on the final results given by the curve. To illustrate this point, the male distribution of 1927 has been grouped in decennial age-groups; no correction has been applied to the first four moments and thus I obtained the following curve which represents the distribution,

$$y = y_0 \frac{2.349.106}{(10.557.839-x)} \quad \text{..... (A)}$$

FIG. 3.

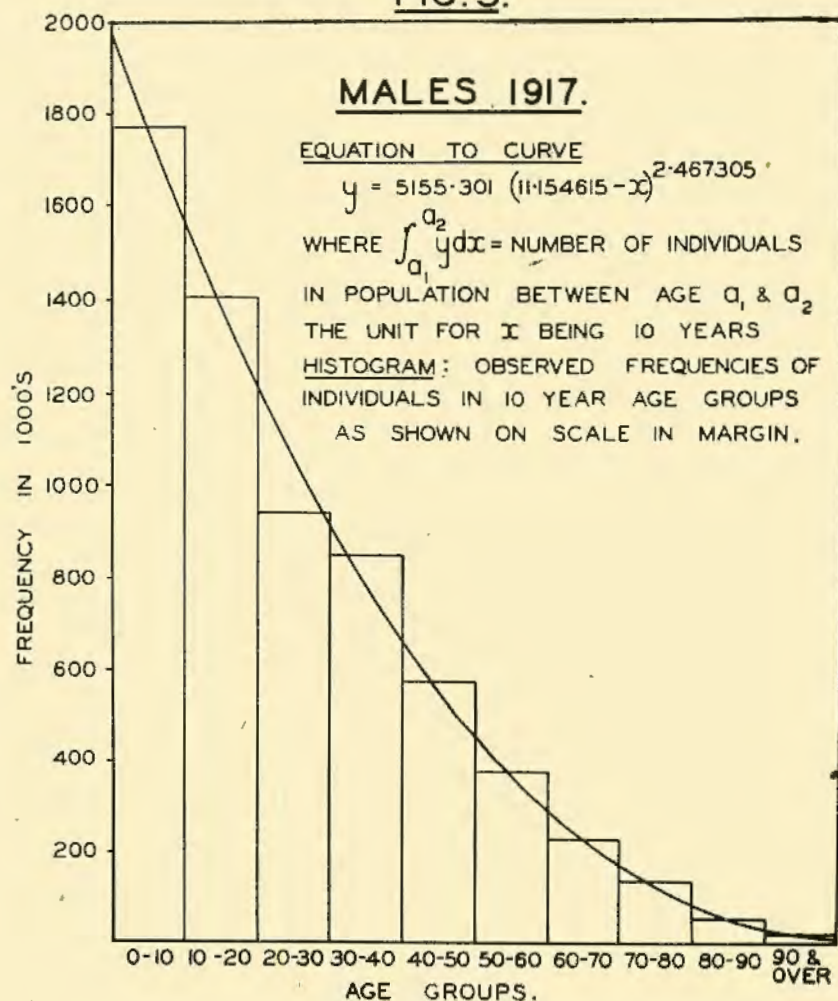
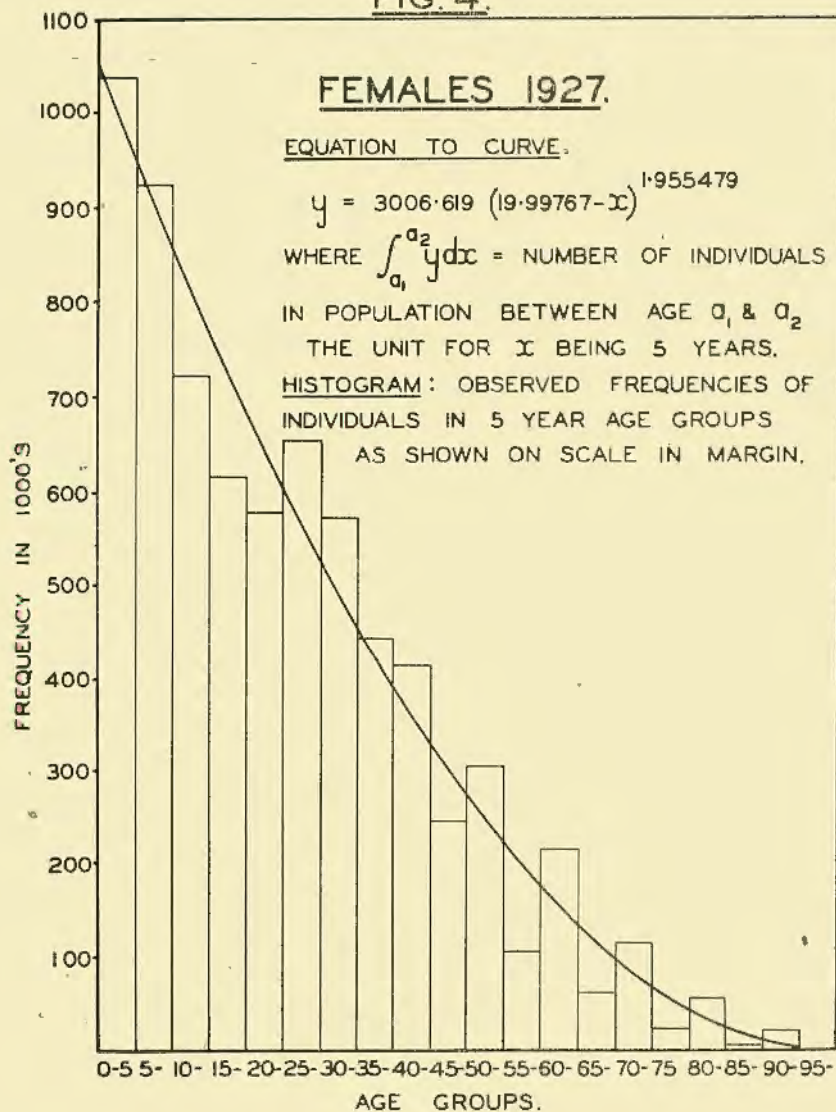


FIG. 4.



This curve should be compared with that fitting the distribution when it is grouped in quinquennial age-groups, having its first three moments corrected and equal to those of the distribution. This curve is represented by

$$y=y_0 (2.094,194 - 19.984,04-x) \dots\dots\dots (B).$$

It should be noted that the unit of grouping of the age "x" is 10 years for the first curve, and 5 years for the second curve.

Table 4 gives the number of males in decennial age-groups according to the 1927 Census, after distributing the number whose ages are not stated; also the graduated figures for each group deduced by the two curves mentioned above.

TABLE 4.—SHOWING AGE-DISTRIBUTION OF MALE POPULATION FOR THE CENSUS OF 1927 AND THE GRADUATED FIGURES BY CURVES A AND B.

| Ages              | Census Numbers | Graduated Numbers : Curve A. | Graduated Numbers : Curve B. |
|-------------------|----------------|------------------------------|------------------------------|
| 0-9 ... ..        | 1,936,923      | 2,000,371                    | 1,964,946                    |
| 10-19 ... ..      | 1,544,606      | 1,564,603                    | 1,556,741                    |
| 20-29 ... ..      | 1,099,106      | 1,189,158                    | 1,197,930                    |
| 30-39 ... ..      | 990,272        | 871,611                      | 887,923                      |
| 40-49 ... ..      | 663,657        | 609,342                      | 626,077                      |
| 50-59 ... ..      | 392,349        | 399,464                      | 411,625                      |
| 60-69 ... ..      | 245,284        | 238,765                      | 243,673                      |
| 70-79 ... ..      | 120,724        | 123,575                      | 121,114                      |
| 80-89 ... ..      | 47,056         | 49,561                       | 42,488                       |
| 90-upwards ... .. | 18,096         | 11,623                       | 5,556                        |
| TOTAL ... ..      | 7,058,073      | 7,058,073                    | 7,058,073                    |

Diagram 5 helps in showing the difference between the two curves; the data are represented by the histograms, Curve A is shown by a dotted line and Curve B by a continuous line. Thus, it can be seen that the difference between the two curves is so small that it will hardly affect the final results. In other words, the Life-Tables calculated on the basis

FIG. 5.

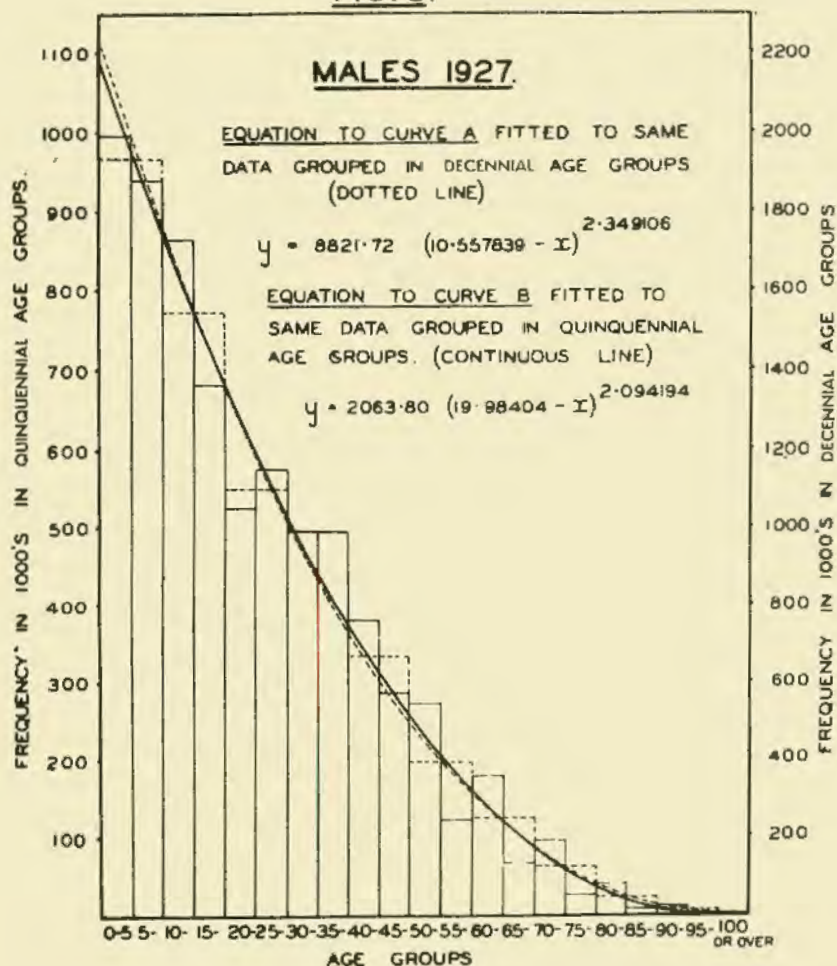
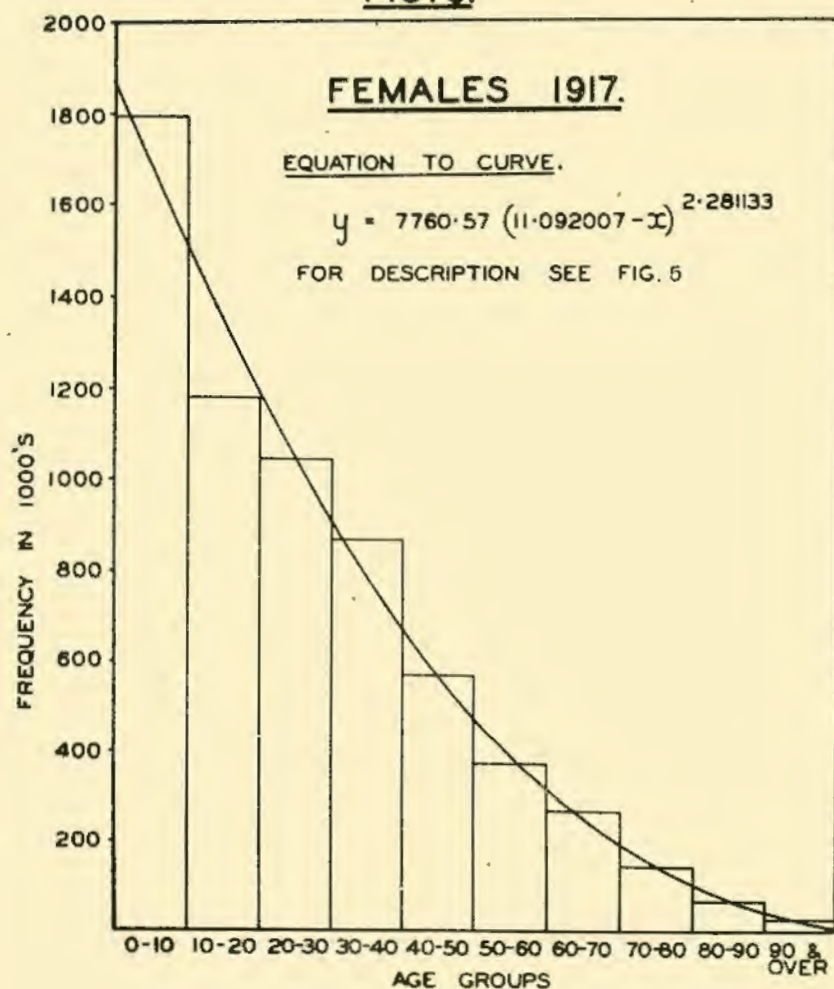


**FIG. 6.**

of the curve, as will be explained later, will hardly be affected, especially if we bear in mind that it is by no means certain that the true curves would be quite the same as those mathematically deduced and that no pretence is made for absolute accuracy. However, I believe that the curves give a nearer approximation to the truth than the obvious erroneous numbers of the Census enumerations. With these considerations in mind, I believe that such a graduation adopted and explained in the Appendix to this paper seems to be the safest guide through the enormous anomalies and irregularities presented in the distribution.

### V.—Mis-statement of Age in the Returns of the Census

It is possible to make use of the graduated curves to analyse the irregularities in the age-distribution which are so marked in figure (1) and (2). I shall use the 1927 figures and follow the method adopted by Dr. James Craufurd Dunlop, then Registrar-General for Scotland, in connection with his study of the amount of error in the returns of the Scottish Census of 1921\*. I shall consider, for each sex and age, the differences between my graduated frequencies and the recorded frequencies. These differences are so remarkable that they suggest a systematic mis-statement of age associated with definite preferences for certain digits.

Unfortunately because of the destruction of the 1927 Census Schedules, I am not able to study the ages of children separately, but I hope to do this after the census of 1937, and will then submit another paper. In the present paper, ages of children will be studied together with those of the rest of the population, without any discrimination, although the method is not quite adequate in the case of children. The method consists of "assuming that all differences between the numbers given by the graduated population curve and the reported numbers are errors in excess, or plus errors, when the reported numbers are greater than the graduated numbers, and errors in deficit, or minus errors, when the reported numbers are less than the graduated numbers."

In Tables (5) and (6) the enumerated numbers in 1927 and 1917, for each sex, are given together with the corresponding graduated figures, to show how far these figures indicate an inadmissible degree of discrepancy. It may be well to state certain salient facts as to the distribution of errors in Table (5). In looking at the Table, we note, firstly, after age 55,

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\* Journal of the Royal Statistical Society, Vol. LXXXVI, year 1923, p. 547 *et seq.*

the percentage of errors, either plus or minus is very high. It is, on the whole, similar in both sexes but of greater magnitude in females. Moreover, it seems quite probable that the older people are apt to exaggerate their ages unintentionally. Secondly, the reported ages of the male population of 7,058,073, contain errors in excess and therefore errors in deficit, amounting to 329,633, while the reported ages of the females population of 7,119,794 contain errors amounting to 499,956. The maximum error for males, amounting to 116,682 in deficit, occurs in the age period 20-24. This deficiency may be attributed to the fact that the official conscription age occurs in that particular age-group and individuals may mis-state their age, lest they may be forced to recruit. This indicates that although there has undoubtedly been a progressive improvement in the organisation and administration of the Census operations and the population is more accustomed to the idea of it, yet its true object is not yet fully appreciated. With females, the maximum error, 105,966 females in deficit, occurs in the age-period 15-20. This may be due to the fact that unmarried girls unconsciously minimise their ages. It may plausibly be argued that this apparent deficiency may be due to concealment of girls at that age. But this is an extreme view to take of the matter, for we have no justification whatsoever to suspect the concealment of women in any period of life, especially if we remember that nothing of the kind was detected in the course of testing the work of the enumerators.

Thirdly and finally, the error in the middle-life period is in excess i.e. the reported numbers in these age-groups are greater than the graduated numbers. This may be caused by individuals having favourite ages which lie almost within the range of the middle-life period; in case of males, these favourite ages are 35, 30, 40, 50 and 45 respectively, while the female ages are 30, 40, 35, 50, 45 respectively.

Comparison of Tables (5) and (6), seems to show that in 1927, males and females tended to give 40, 50, 60 or 70 as their age; alternately in excess and deficit. In 1917, with ten years grouping, these errors are much less.

The comparison between the errors found at the Census of 1927 and those found, by the same method, in the returns of the Census of 1917, indicated in Table 6, does not show any marked improvement in the returns. It is rather curious that the deficiency in the age-period 10-20 for females and 20-30 for males is also markedly noted on 1917 Census; and what is more, it is in accordance with the results obtained from investigating the ages of the Indian population. The

TABLE 5.—GRADUATED AND REPORTED NUMBERS IN EACH QUINQUENNIAL AGE-GROUP: MALES AND FEMALES, 1927.

| Age-Groups | Males     |           |          |       | Females   |           |          |       |
|------------|-----------|-----------|----------|-------|-----------|-----------|----------|-------|
|            | Census    | Graduated | Errors   | %     | Census    | Graduated | Errors   | %     |
| 0-4        | 997,050   | 1,036,610 | -39,560  | -3.8  | 1,039,310 | 1,001,614 | 37,696   | 3.7   |
| 5-9        | 939,873   | 928,336   | 11,537   | 1.2   | 924,695   | 903,642   | 21,053   | 2.3   |
| 10-14      | 862,723   | 826,299   | 36,424   | 4.4   | 721,530   | 810,604   | -89,074  | -11.0 |
| 15-19      | 681,883   | 730,442   | -48,559  | -6.6  | 616,553   | 722,519   | -105,966 | -14.7 |
| 20-24      | 524,068   | 640,750   | -116,682 | -18.2 | 578,980   | 639,381   | -60,401  | -9.4  |
| 25-29      | 275,038   | 557,180   | 17,858   | 3.2   | 654,562   | 561,220   | 93,342   | 16.6  |
| 30-34      | 495,616   | 479,687   | 15,929   | 3.3   | 572,756   | 488,046   | 84,710   | 17.4  |
| 35-39      | 494,656   | 408,236   | 86,420   | 21.1  | 443,774   | 419,876   | 23,898   | 5.7   |
| 40-44      | 378,949   | 342,789   | 36,160   | 10.5  | 412,801   | 356,725   | 56,076   | 15.7  |
| 45-49      | 284,708   | 283,288   | 1,420    | .5    | 243,593   | 298,615   | -55,022  | -18.4 |
| 50-54      | 271,272   | 229,690   | 41,582   | 18.1  | 303,976   | 245,563   | 58,413   | 23.8  |
| 55-59      | 121,077   | 181,935   | -60,858  | -33.5 | 106,728   | 197,594   | -90,866  | -46.0 |
| 60-64      | 177,799   | 139,965   | 37,834   | 27.0  | 213,731   | 154,732   | 58,999   | 38.1  |
| 65-69      | 67,485    | 103,708   | -36,223  | -34.9 | 61,417    | 117,006   | -55,589  | -47.5 |
| 70-74      | 93,868    | 73,091    | 20,777   | 28.4  | 113,768   | 84,449    | 29,319   | 34.7  |
| 75-79      | 26,856    | 48,023    | -21,167  | -44.1 | 24,675    | 57,103    | -32,428  | -56.8 |
| 80-84      | 39,551    | 28,399    | 11,152   | 39.3  | 57,003    | 35,009    | 21,994   | 62.8  |
| 85-89      | 7,505     | 14,089    | -6,584   | -21.4 | 7,621     | 18,232    | -10,611  | -58.2 |
| 90 & c.    | 18,096    | 5,556     | 12,540   | 225.7 | 22,320    | 7,864     | 14,456   | 183.8 |
| TOTAL ...  | 7,058,073 | 7,058,073 | ±329,633 |       | 7,119,794 | 7,119,794 | ±499,956 |       |

TABLE 6.—GRADUATED AND REPORTED NUMBERS IN EACH DECENNIAL AGE-GROUP: MALES AND FEMALES 1917.

| Age-Groups | Males     |           |                      |       | Females   |           |                      |       |
|------------|-----------|-----------|----------------------|-------|-----------|-----------|----------------------|-------|
|            | Census    | Graduated | Errors               | %     | Census    | Graduated | Errors               | %     |
| 0-9        | 1,770,508 | 1,770,432 | 76                   | 0·0   | 1,797,114 | 1,692,303 | 104,811              | 6·2   |
| 10-19      | 1,407,500 | 1,388,668 | 18,832               | 1·4   | 1,181,580 | 1,350,001 | -168,421             | -12·5 |
| 20-29      | 924,410   | 1,060,727 | -118,317             | -11·2 | 1,042,901 | 1,050,514 | -7,613               | -0·7  |
| 30-39      | 852,913   | 783,933   | 68,980               | 8·8   | 875,225   | 792,542   | 82,683               | 10·4  |
| 40-49      | 574,765   | 555,426   | 19,339               | 3·4   | 571,017   | 574,639   | -3,622               | -0·6  |
| 50-59      | 376,586   | 372,140   | 4,446                | 1·2   | 377,780   | 395,261   | -17,481              | -4·4  |
| 60-69      | 229,552   | 230,749   | -1,197               | -0·5  | 262,985   | 252,645   | 10,340               | 4·1   |
| 70-79      | 139,072   | 127,594   | 11,478               | 9·0   | 141,775   | 144,800   | -3,025               | -2·1  |
| 80-89      | 55,212    | 58,559    | -3,347               | -5·7  | 71,840    | 69,383    | 2,457                | 3·5   |
| 90 & c.    | 20,999    | 21,289    | -290                 | -1·4  | 26,521    | 26,648    | -127                 | -0·5  |
| TOTAL...   | 6,369,517 | 6,369,517 | +123,151<br>-123,151 |       | 6,348,738 | 6,348,736 | +200,291<br>-200,289 |       |

following note, extracted from the Census of India 1911, Volume I, illustrates the situation in India.

"Intentional mistatement exists chiefly in connection with unmarried girls who have attained the age of puberty, who are almost invariably returned as younger than they really are. Men approaching the meridian of life, especially if they are widowers, also commonly understate their age. Unintentional error in a particular direction occurs chiefly in the case of older people, who are prone to exaggerate their age, and of young wives with children, who also are nearly always entered as older than they are."

There remains then as the subject of inquiry, the determination of the favourite unit digits of age and the order of each unit in respect to the other ten digits. Such an investigation can only be carried out for the male and female populations of 1927, where the numbers of each sex, for individual years of age, are obtainable, but owing to the lack of such data for 1917, we cannot carry out the same investigation.

In Table (9), the reported numbers of males and females for individual years are compared with the corresponding graduated numbers. It can be seen from the table that after age 20, errors in excess are only associated with ages, the unit digits of which are 0 and 5, while all ages ending with any one of the remaining digits contain always errors in deficit.

In Tables (10) and (11), the graduated numbers of males and females are given, to show the true proportions of the individuals whose ages end with each of the ten unit digits; while Tables (12) and (13) are given to demonstrate the amounts of errors in ages ending with each of these unit digit. Moreover, the percentages of the above-mentioned errors are set out in Tables (14) and (15).

It can be seen from the tables, that although all digits of ages, with the exception of those ending in 0 and 5, show errors in deficit, yet the degree of the repulsion of the individuals from these digits is not the same and therefore, we can still arrange these digits in their order of preference. It is rather interesting to compare the ranks of the different digits as shown from the Egyptian population, with those obtained from the Indian\* and Scottish† population.

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\* Mr. Thomas G. Ackland's report submitted to the Indian Government and published in *Journal of the Institute of Actuaries*, Vol. XLVII, part IV, July 1913, p. 315 *et seq.*

† See previous note page 17,

Table 7 shows the rank of each digit of age of the Egyptian and Scottish populations of 1927 and 1921 respectively, together with that of the male population obtained from six provinces in India : Bengal, Bombay, Burma, Madras, Punjab and United Provinces. The rank of each digit of age for the Indian female population is not given in Mr. Ackland's paper.

TABLE 7.—SHOWING THE RANK OF EACH DIGIT OF AGE FOR THE EGYPTIAN MALE AND FEMALE POPULATIONS, FOR SCOTTISH MALES AND FEMALES AND FOR THE INDIAN MALE POPULATION.

| Country  |     |         |     | Digit of Age |    |   |   |   |   |   |   |   |    |
|----------|-----|---------|-----|--------------|----|---|---|---|---|---|---|---|----|
|          |     |         |     | 0            | 1  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  |
| Egypt    | ... | Males   | ... | 1            | 10 | 3 | 5 | 7 | 2 | 6 | 8 | 4 | 9  |
|          |     | Females | ... | 1            | 9  | 4 | 7 | 6 | 2 | 5 | 8 | 3 | 10 |
| India    | ... | Males   | ... | 1            | 9  | 3 | 7 | 6 | 2 | 5 | 8 | 4 | 10 |
| Scotland | ... | Males   | ... | 1            | 10 | 3 | 8 | 6 | 4 | 5 | 9 | 2 | 7  |
|          |     | Females | ... | 1            | 10 | 5 | 8 | 6 | 4 | 3 | 9 | 2 | 7  |

The above figures indicate that there is a remarkable preference for the even digits in the three countries. In Egypt and India they can be arranged in the following order : 2, 8, 6, and 4 ; whilst the odd digits may be arranged as follows : 3, 7, 1 and 9 ; but in Scotland the digit 9 replaces the digit 3, and the digit 8 replaces the digit 2.

## VI.—Graduated Life-Tables

The graduated figures for individual ages for the male and female populations of 1927 and 1917, deduced by the mathematical formulæ mentioned in the Appendix, would serve as a basis for calculating the probability of living 10 years at age  $x$  ( $_{10}p_x$ ) for each sex. To illustrate the method, let us confine ourselves to male Life-Tables. The female Life-Tables can be constructed by a method exactly similar.

The number of males in 1917,  $n$ , whose age is exactly  $x$  can be easily calculated from the formula :—

$$n_x = \int_{(x-\frac{1}{2})h}^{(x+\frac{1}{2})h} y_0 (11.154615-x) \quad 2.467305 \quad dx \dots\dots\dots (1)$$

where  $h=.1$

Then we may argue that, during the interval between the Census of 1917 and that of 1927, some of these individuals died and those who lived should have returned their age, in the Census of 1927, as  $(x+\delta)$  years, where  $\delta$  is the interval between the two Censuses amounting to 9.96164 years. If the interval  $\delta$  between the two Censuses was exactly ten years, we could easily have calculated the numbers of individuals whose age was exactly  $(x+10)$  in 1927 from the following equation—

$$n'_{x+10} = \int_{(x+10-\frac{1}{2})h}^{(x+10+\frac{1}{2})h} y_0 (19.98404-x) \quad 2.094194 \quad dx \dots\dots\dots (2)$$

where  $h=.2$ ,

and eventually obtained two sets of numbers ; ( $n_x$  and  $n'_{x+10}$ ), from which we could have deduced the probability of surviving ten years ( $_{10}p_x$ ) at each age of life. These values of  $_{10}p_x$  could have been obtained from the simple formula :—

$$_{10}p_x = \frac{n'_{x+10}}{n_x} \dots\dots\dots (3)$$

But owing to the fact that the Census of 1917 was carried on March 7, 1917 and that the last Census was taken on February 19, 1927, the interval between the two Censuses is 16 days less than 10 years, so the number of the individuals who should return their ages as  $(x+10)$  had the Census of 1927 been taken on March 7, will be less than the value of  $n'_{x+10}$  obtained from equation (2), i.e.  $n_{x+10}$  instead of  $n'_{x+\delta}$ . An approximation to the true value of  $n_{x+10}$  can be obtained from  $n'_{x+\delta}$  by subtracting from it,  $.03836 \delta n'_{x+10}$  ; where  $\delta n'_{x+10} = n'_{x+10} - n'_{x+11}$ . It should be noted that because the interval between the two Censuses is less than the 10 years by 16 days only, such an approximation may be reasonable.

Having obtained the two series of  $_{10}p_x$  for both sexes, it remains to determine the probability of living one year ( $p_x$ ) at each age: Before discussing the process of obtaining the values of  $p_x$ , it should be noted, that the aim of this paper is to construct the Egyptian Life-Tables from age 10 to the end of life only because I feel that the data and even the curves concerning the ages of infancy and childhood are not quite reliable and therefore it is not worth the trouble to make any elaborate and detailed investigation at these early ages. It can be easily seen that, since we got the series of the values of  $_{10}p_x$  for males and females for each age, from  $x=10$  to the end of life, than all we need is a method to provide us with the first ten values of  $l_{11}, l_{12}, l_{13}, \dots, l_{20}$ , i.e. the number of survivors, at age  $x$ , from the arbitrary radix  $l_{10}$  of 100,000; for once we get these ten values, we can automatically get the next ten, namely  $l_{21}, l_{22}, \dots, l_{30}$  by simply multiplying  $l_{11}$  by  $_{10}P_{11}$ ;  $l_{12}$  by  $_{10}P_{12}$  ...; and  $l_{20}$  by  $_{10}P_{20}$ .

To get the first set of  $l_x$ , we simply calculate the number of survivors at age 20, 30 and 40, on the assumption that the radix  $l_{10}=100,000$ , and then we fit these four points by means of Makeham's first modification of Gompertz's formula. In the case of males, this formula becomes:  $\log l_x = 5.0740096 - 0.408639x - 0.212053 (1.5630864)^x \dots \dots (4)$  while that for females becomes:—

$$\log l_x = 5.0616564 - 0.281468x - 0.216594 (1.5471158)^x \dots \dots (5)$$

From equation (4) and (5) we can calculate the first set of  $l_x$ , namely  $l_{11}, l_{12}, \dots, l_{20}$  for males and females respectively, and therefore all values, of  $l_x$  from age 10 to the end of life can be obtained, for both sexes, as explained above.

It is interesting to see the degree of accuracy of the first ten values of  $l_x$  deduced by Makeham's modification of Gompertz's Law. For this purpose the values of  $_{10}p_x$ , deduced by dividing  $l_{x+10}$  by  $l_x$ , have been compared with the corresponding values of  $_{10}p_x$  deduced by the graduated frequency curves, as illustrated above. The results are remarkably surprising for all the intermediate values for ages between 10 and 30 i.e. throughout the whole range of the part of the survivors-curve fitted by Makeham's Law. The degree of closeness of the approximation can be shown by the fact that the maximum absolute difference between any corresponding values of these two sets of  $_{10}p_x$  amounts to 7 in the fifth decimal place.

For the purpose of illustration these 21 values of  $10p_x$  for females  $x=10$  to  $x=30$  as deduced by Makeham's Law, together with the corresponding values obtained from the graduated frequency curves are set out in Table (8).

TABLE 8.—SHOWING THE PROBABILITY OF LIVING TEN YEARS ( $10p_x$ ) AT AGE  $x$ , FOR FEMALE LIVES, AS DEDUCED BY MAKEHAM'S MODIFICATION OF GOMPERTZ' LAW, AND BY THE GRADUATED FREQUENCY CURVES.

| Age $x$ | $10p_x$ Frequency Curves | $10p_x$ Makeham's Law | Difference |
|---------|--------------------------|-----------------------|------------|
| 10      | .89850                   | .89850                | .00000     |
| 11      | .89680                   | .89681                | .00001     |
| 12      | .89504                   | .89505                | .00001     |
| 13      | .89320                   | .89321                | .00001     |
| 14      | .89127                   | .89130                | .00003     |
| 15      | .88929                   | .88930                | .00001     |
| 16      | .88716                   | .88722                | .00006     |
| 17      | .88506                   | .88505                | .00001     |
| 18      | .88273                   | .88280                | .00007     |
| 19      | .88039                   | .88044                | .00005     |
| 20      | .87799                   | .87800                | .00001     |
| 21      | .87541                   | .87541                | .00000     |
| 22      | .87280                   | .87280                | .00000     |
| 23      | .86997                   | .86997                | .00000     |
| 24      | .86709                   | .86709                | .00000     |
| 25      | .86411                   | .86411                | .00000     |
| 26      | .86097                   | .86097                | .00000     |
| 27      | .85769                   | .85774                | .00005     |
| 28      | .85435                   | .85435                | .00000     |
| 29      | .85086                   | .85083                | .00003     |
| 30      | .84717                   | .84716                | .00001     |

# VII.—Comparison of Rates of Mortality

Having calculated all the values of  $1x$ , we can easily calculate the values of  $p_x$ —the probability of surviving one year at age  $x$ —from age ten to the end of life. For purpose of comparison, I have set out in Table (16), the values of  $100(q_x=1-p_x)$  is the probability that a person of precise age  $x$  will die within one year for Egypt together with the corresponding values for India, England and Lagos. The values of  $100q$  for India are those deduced by Mr. Akland for male and female lives of all India (1901-1911); while the English figures have been taken from the English Life-Table No. 9.

I am indebted to Dr. E. S. Pearson for referring me to the work of Mr S. M. Jacob, the Government Statistician for Nigeria, to compare the results obtained for Egypt with other African results. Mr. Jacob did not calculate a Life-Table for all Nigeria, the population of which in 1931 was reported to be 19,928,171 persons, but he confined himself to the male population of Lagos, the seat of Government, and the population of which is 126,108 persons. But because Lagos, being the Capital and situated on the sea coast, is much healthier than the rest of Nigeria, its rates of mortality are much lower, and therefore not representative of the whole country. It is of interest, in this connection to cite the following passage from Mr. Jacob's report, Census of Nigeria, 1931, Vol. 1.

"On the other hand, though Lagos, with 85 per cent of that tribe, is predominately a Yoruba town, it offers, both on account of its position as a sea-port, through which three-fifths of the import and half of the export trade of Nigeria passes, and as the seat of Government, an unrepresentative sample even of Yorubaland. Still less is it representative of Southern Nigeria."

Bearing this in mind, it is not surprising to see that the rates of mortality in Lagos, as given in Table XLI, "Life-Table for decade 1921-1930." Census of Nigeria 1931, Vol. 1., are slightly lower than those of Egypt as a whole.

In England, as might be anticipated, the rates of mortality for both males and females at ages 10 to 70 are much lower than the corresponding rates for Egypt, but after age 60 the Egyptian rates of mortality are slightly lower than the corresponding rates for England and Lagos. It might be argued that this is the effect of mis-statement of age by older persons in the Census returns; but we must remember that the rates of mortality in England have not improved during the last half-century and are still notably high; a similar phenomenon has been observed in connection with the German and Italian populations, namely the Italian Survivors-curve crosses, at a certain age, the German curve, a fact which indicates that although in earlier ages the Italian's rates of mortality are higher than those of Germany, yet after, a certain age, they are lower. Therefore we may come to the conclusion that such a similar phenomenon for Egypt and England is not due to mis-statement of age, but may be regarded as a natural and quite probable phenomenon, in spite of the fact that of mis-statement of age at old ages has undoubtedly a certain effect.

With regard to India, the mortality rates are considerably higher than those of Egypt for both male and female lives. The effect of different rates of mortality operating on different populations can be studied by comparing the numbers of survivors, at each age, out of an arbitrary radix for the different populations. For the purpose of simplifying the comparison, figures (7) and (8) have been drawn. The first figure indicates the male Survivors-curves for Egypt, India, England and Lagos, while the second represents the female Survivors-curves for the first three countries only, for, as indicated above, the Female Life-Table for Lagos has not been calculated. The number out of 1,000 persons aged 10, of males (or females) surviving at age  $x$ , is represented by the ordinates of the curve corresponding to each race.

### VIII.—Comparison of Expectations of Life

Having got the values of  $l_x$ ,  $p_x$ , and  $q_x$ , it remains to calculate, firstly, the number living between age  $x$  and  $(x+1)$ , ( $L_x$ ); secondly, the number living above age  $x$ , ( $T_x$ ), and finally the complete expectation of life, at age  $x$ , ( $e^0_x$ ).

The values of  $L_x$ , for ages from 10 to the end of life, have been deduced from the approximate formula

$$L_x = \frac{l_x + l_{x+1}}{2}$$

which is quite applicable to adult ages. The values of  $T_x$  can be obtained simply by summing the values of  $L_x$  from and including age  $x$  upwards, while the complete expectation of life at age  $x$  can be deduced by dividing the corresponding value of  $T_x$  by the number of survivors at age  $x$ . I did not calculate the values of the force of mortality, but they can be easily obtained, if required, by using the formula of approximation

$$\mu_x = \frac{l_{x-1} - l_{x+1}}{2 l_x}$$

Table 17 shows the expectation of life at ages 10, 15, 20, 25 ..... and 100, for male and female lives deduced by the above-mentioned

FIG. 7.  
LIFE DURATION OF DIFFERENT RACES.

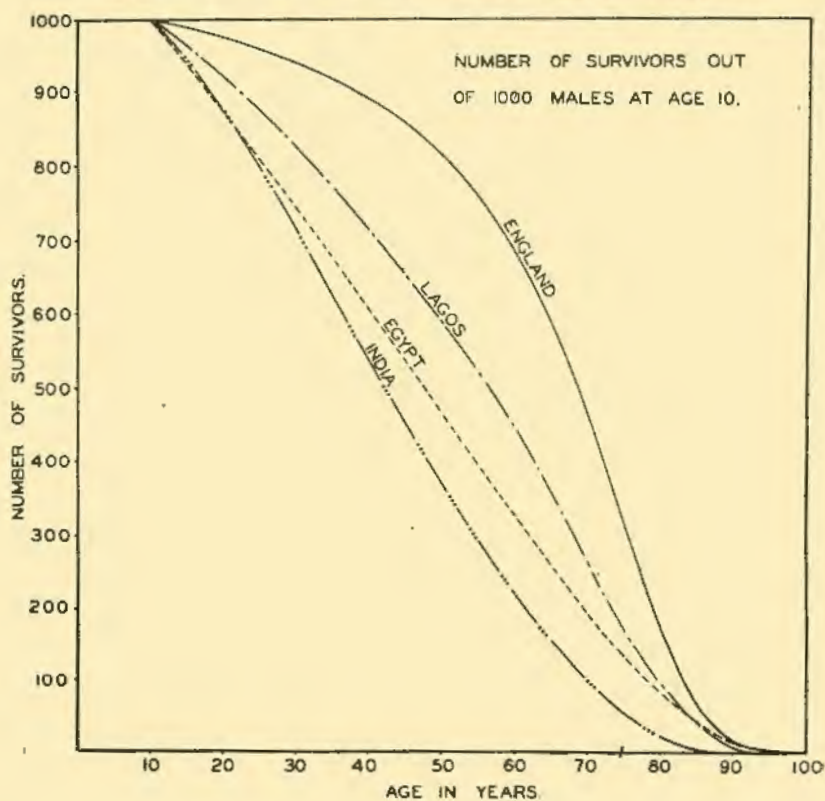
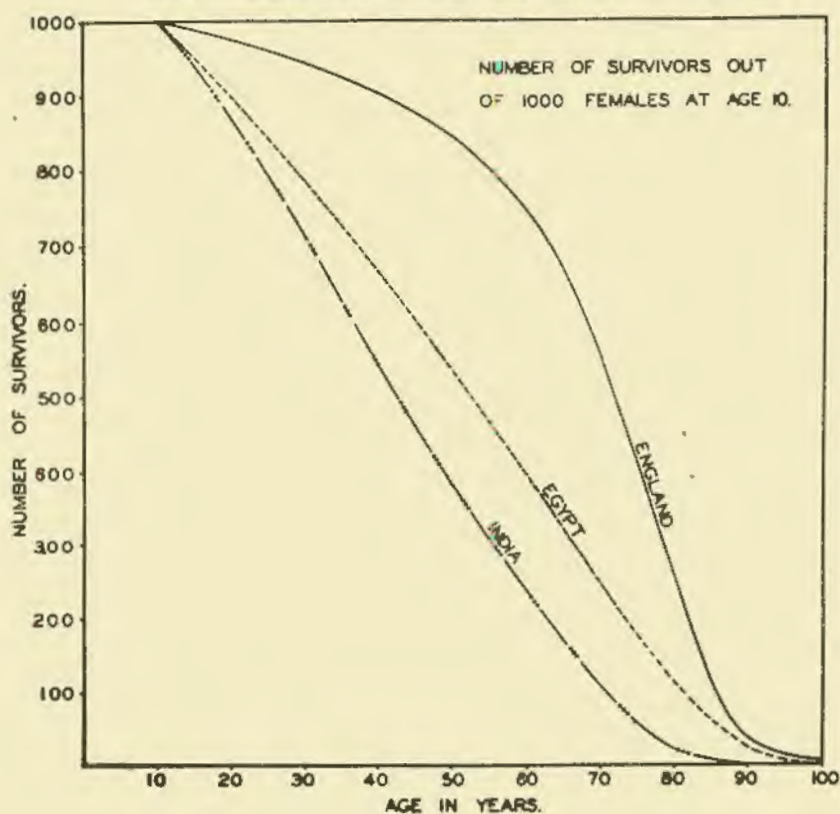


FIG. 8.  
LIFE DURATION OF DIFFERENT RACES.



method, together with the corresponding expectations of life for England,\* India; and the male expectation of life for Lagos.

At all ages the expectations of life in Egypt, for both males and females, are considerably higher than those of India. Moreover, the two expectation-curves for Egyptian males and females, as represented in Diagrams (9) and (10), are practically parallel to the corresponding Indian males and females expectation-curves, a fact which indicates that Egypt retains a higher vitality than India in all ages by practically the same amount.

A glance at the two above-mentioned diagrams, serves also to show that the higher vitality which the Egyptian females hold over the Indian females, is greater than the higher vitality which the Egyptian males hold over the Indian males. The appropriate explanation of this lies in Mr. Ackland's statement, page 347.

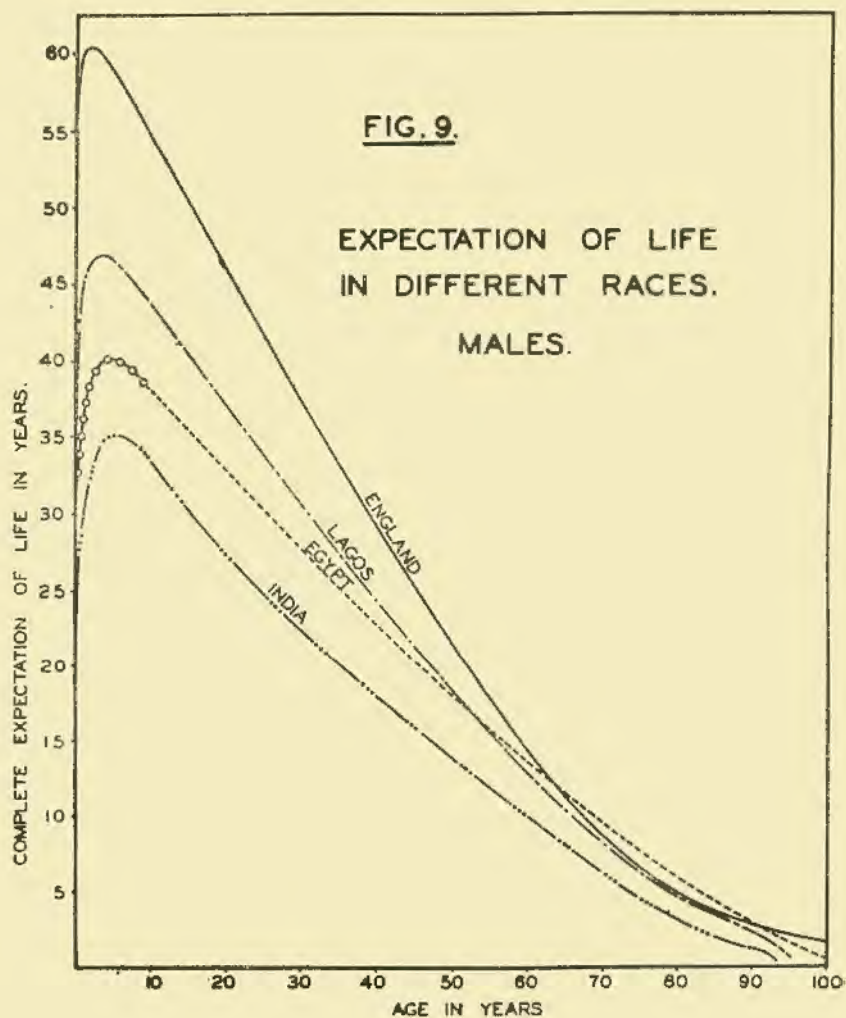
"The expectations for female lives in all India are only slightly higher than for male lives, at all ages, the excess being 0.72 years at birth, diminishing to 0.11 at age 60; whilst in England, the superior expectation of the female lives in 3.98 years at birth, and 1.43 years at age 60." On the other hand, Egypt shows an inferior vitality compared with England and Lagos, throughout the greater part of the curve, and a slightly superior vitality to that of England itself at old ages. The Egyptian male expectation-curve crosses the corresponding curve for Lagos at age 54, and it continues to show a superior vitality over Lagos from this age to the end of life; while it crosses the English expectation-curve at age 64, and then it proceeds to show higher values of expectations up to age 91, where it crosses the English curve again. I believe that the second intersection of the two curves at age 91 may be due to the inaccuracy of the values of expectation for Egypt at very old ages, compared with the accuracy attained for the English values at these ages. Had the same standard of accuracy been attained for both curves, the Egyptian curve should not have crossed the English curve again.

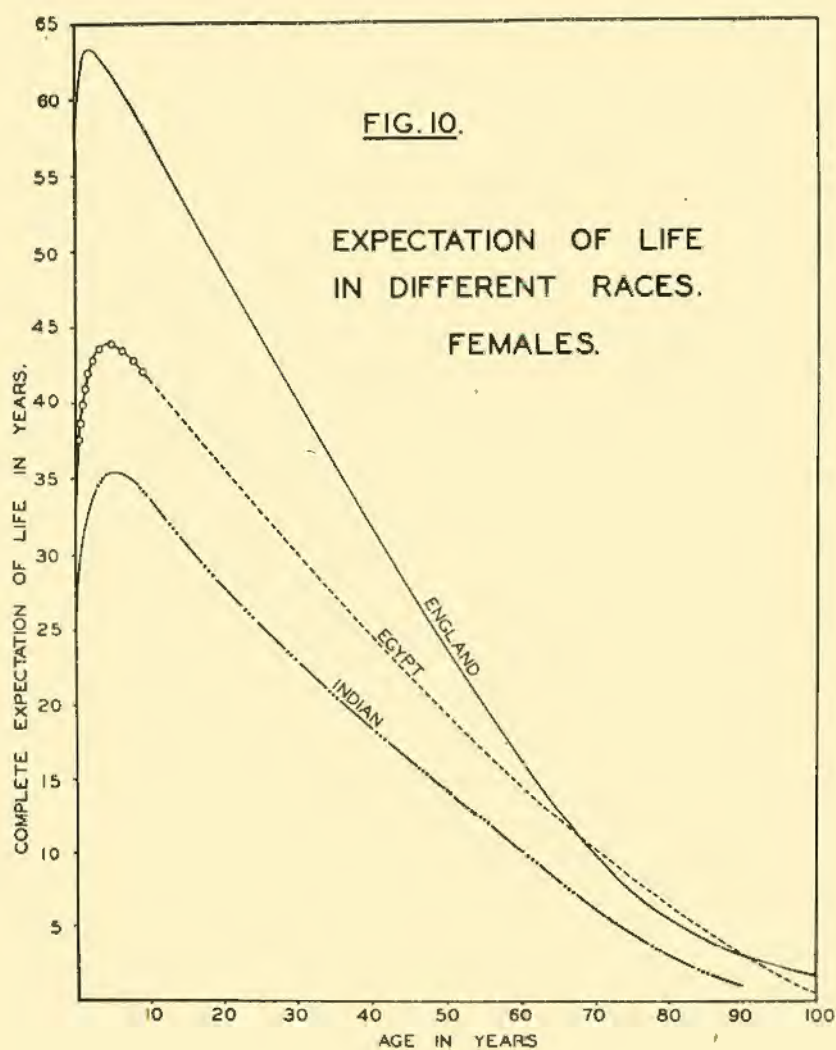
The Egyptian female expectation-curve shows a similar phenomenon. It is practically parallel to that of India, and shows an inferior vitality, compared with England, at ages 0 to 69 and a slightly higher vitality from age 69 to 90, the age where it intersects the English curve again.

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\* Registrar General. Life-Table No. 9.

See Note Page 23.





As I have already mentioned before, I have not tried owing to lack of accuracy at the very early ages, to apply any elaborate and detailed investigation at these ages. I have, however, drawn in on Diagrams (9) and (10) two curves which I suggest as rough approximation to the true expectation-curves between 0 and 10 years. It will be seen that these curves suggest that the expectation at birth is 31 years for males and 36 for females, compared to the English 55·62 years for males and 59·8 for females; and to the Indian 25·59 for males and 23·31 for females. The probable difference in maximum expectations in the different countries can also be seen.

In Egypt it is 40·2 at age 4 for male and 44·0 at age 4 for females; whilst in India the maximum expectation is attained at age 5 for both sexes and amounts to 35·01 years for males and 35·40 years for females; whereas in England the maximum expectation is attained at age 2 for both males and females and amounts to 60·50 years for males and 63·35 for females.

In Table (20), I have tried to give, for both sexes, the ages for England, India and Lagos, for which the expectations of life are approximately equal to the Egyptian expectations at ages 10, 20, 30..... and 100. In the case of males, out of the three different races, Lagos, India and England, only the African one, namely Lagos, shows the nearest figure to the corresponding Egyptian ages. In the case of females, however, I expect the Lagos result would correspond most nearly to the Egyptian, but, as I have said before, these are not given.

### IX.—Conclusion

In conclusion, I should like to express my gratitude to Mr. J. I. Craig, the Financial Secretary of the Ministry of Finance, Cairo, with whom I have been in constant touch, during the course of my investigation. His valuable suggestions and remarks together with his intimate acquaintance with the Census operations and the prominent defects of the Vital Statistics Registration has simplified the task which seemed, at first glance, to be impossible to carry out.

I also wish to express my hearty thanks to Dr. E. S. Pearson, the Professor of Applied Statistics, University College, London, for his useful statistical advice, for reading the paper and for allowing all the diagrams to be drawn in the Department.



TABLE No. 9.—COMPARISON OF THE GRADUATED NUMBERS OF MALES AND FEMALES, DEDUCED FROM THE PEARSONIAN CURVES FOR 1927 CENSUS, WITH THE CORRESPONDING NUMBERS ACTUALLY REPORTED IN EACH INDIVIDUAL YEAR.

| Age   | Males    |           |         | Females  |           |         |
|-------|----------|-----------|---------|----------|-----------|---------|
|       | Numbers  |           | Errors  | Numbers  |           | Errors  |
|       | Reported | Graduated |         | Reported | Graduated |         |
| 0-1   | 249,166  | 216,281   | —       | 243,785  | 208,396   | 35,389  |
| 1-2   | 127,462  | 211,754   | 84,292  | 135,141  | 204,309   | —       |
| 2-3   | 207,314  | 207,272   | 42      | 221,127  | 200,291   | 20,836  |
| 3-4   | 208,750  | 202,839   | 5,911   | 223,729  | 196,283   | 27,446  |
| 4-5   | 201,769  | 198,464   | 3,305   | 212,452  | 192,335   | 20,117  |
| 5-6   | 223,041  | 194,128   | 28,913  | 223,627  | 188,406   | 35,221  |
| 6-7   | 199,518  | 189,850   | 9,668   | 204,155  | 184,527   | 19,628  |
| 7-8   | 155,490  | 185,620   | 30,130  | 149,360  | 180,689   | 31,329  |
| 8-9   | 260,167  | 181,434   | 78,733  | 249,240  | 176,886   | 72,354  |
| 9-10  | 99,217   | 177,304   | 78,087  | 95,576   | 173,134   | 77,558  |
| 10-11 | 282,276  | 173,227   | —       | 244,564  | 169,404   | 75,160  |
| 11-12 | 56,475   | 169,190   | 112,715 | 48,550   | 165,725   | —       |
| 12-13 | 293,741  | 165,211   | —       | 228,600  | 162,080   | 66,520  |
| 13-14 | 109,367  | 161,277   | 51,910  | 90,310   | 158,479   | —       |
| 14-15 | 118,624  | 157,394   | 38,770  | 107,371  | 154,916   | 68,169  |
| 15-16 | 240,093  | 153,559   | —       | 186,107  | 151,393   | 47,545  |
| 16-17 | 104,937  | 149,773   | 44,836  | 111,940  | 147,907   | —       |
| 17-18 | 92,400   | 146,042   | 53,642  | 78,390   | 144,462   | 35,967  |
| 18-19 | 154,598  | 142,352   | 12,246  | 187,412  | 141,058   | 66,072  |
| 19-20 | 88,085   | 138,716   | 50,631  | 50,879   | 137,699   | —       |
| 20-21 | 192,208  | 135,130   | 57,078  | 353,290  | 134,368   | 86,820  |
|       |          |           | —       |          |           | 218,922 |

|       |         |         |        |         |         |         |         |
|-------|---------|---------|--------|---------|---------|---------|---------|
| 21-22 | 70,832  | 131,593 | 60,761 | 29,100  | 131,079 | —       | 101,979 |
| 22-23 | 122,554 | 128,099 | 5,545  | 101,452 | 127,839 | —       | 26,387  |
| 23-24 | 77,748  | 124,661 | 46,913 | 49,600  | 124,628 | —       | 75,028  |
| 24-25 | 59,365  | 121,267 | 61,902 | 43,824  | 121,468 | —       | 77,644  |
| 25-26 | 327,921 | 117,926 | —      | 463,728 | 118,335 | 345,393 | —       |
| 26-27 | 54,506  | 114,634 | 60,128 | 34,572  | 115,251 | —       | 80,679  |
| 27-28 | 71,969  | 111,387 | 39,418 | 48,980  | 112,205 | —       | 63,225  |
| 28-29 | 98,688  | 108,191 | 9,503  | 91,362  | 109,197 | —       | 17,835  |
| 29-30 | 20,461  | 105,042 | 84,581 | 13,983  | 106,232 | —       | 92,249  |
| 30-31 | 372,407 | 101,940 | —      | 486,263 | 103,299 | 382,964 | —       |
| 31-32 | 15,990  | 98,892  | 82,902 | 9,444   | 100,420 | —       | 90,976  |
| 32-33 | 62,083  | 95,890  | 33,807 | 46,657  | 97,569  | —       | 50,912  |
| 33-34 | 26,074  | 92,936  | 66,862 | 16,169  | 94,762  | —       | 78,593  |
| 34-35 | 17,775  | 90,029  | 72,254 | 12,528  | 91,994  | —       | 79,466  |
| 35-36 | 379,499 | 87,169  | —      | 366,906 | 89,268  | 277,638 | —       |
| 36-37 | 23,270  | 84,361  | 61,091 | 13,789  | 86,582  | —       | 72,793  |
| 37-38 | 28,721  | 81,601  | 52,880 | 16,967  | 83,936  | —       | 66,969  |
| 38-39 | 50,196  | 78,885  | 28,689 | 36,685  | 81,329  | —       | 44,644  |
| 39-40 | 11,686  | 76,220  | 64,534 | 8,114   | 78,762  | —       | 70,648  |
| 40-41 | 324,856 | 73,599  | —      | 376,340 | 76,236  | 300,104 | —       |
| 41-42 | 7,561   | 71,037  | 63,476 | 4,750   | 73,751  | —       | 69,001  |
| 42-43 | 25,825  | 68,509  | 42,684 | 17,552  | 71,305  | —       | 53,753  |
| 43-44 | 12,950  | 66,035  | 53,085 | 8,872   | 68,899  | —       | 60,027  |
| 44-45 | 6,773   | 63,609  | 56,896 | 4,065   | 66,534  | —       | 62,469  |
| 45-46 | 237,009 | 61,228  | —      | 213,491 | 64,210  | 149,281 | —       |
| 46-47 | 9,930   | 58,896  | 48,966 | 5,020   | 61,926  | —       | 56,906  |
| 47-48 | 11,931  | 56,609  | 44,678 | 6,423   | 59,683  | —       | 53,260  |
| 48-49 | 19,704  | 54,374  | 34,670 | 13,754  | 57,479  | —       | 43,725  |
| 49-50 | 5,395   | 52,181  | 46,786 | 4,184   | 55,317  | —       | 51,133  |
| 50-51 | 243,172 | 50,038  | —      | 285,369 | 53,195  | 232,174 | —       |
| 51-52 | 4,058   | 47,942  | 43,884 | 2,685   | 51,113  | —       | 48,428  |
| 52-53 | 11,167  | 45,891  | 34,724 | 7,403   | 49,072  | —       | 41,669  |
| 53-54 | 5,738   | 43,888  | 38,150 | 3,611   | 47,071  | —       | 43,460  |

TABLE No. 0 (contd.).

| Age   | Males    |           |        | Females  |           |         |
|-------|----------|-----------|--------|----------|-----------|---------|
|       | Numbers  |           | Errors | Numbers  |           | Errors  |
|       | Reported | Graduated |        | Reported | Graduated |         |
| 54-55 | 6,433    | 41,931    | —      | 4,008    | 45,112    | —       |
| 55-56 | 101,446  | 40,022    | 61,424 | 93,666   | 43,194    | 50,472  |
| 56-57 | 5,215    | 38,158    | —      | 2,915    | 41,315    | —       |
| 57-58 | 4,989    | 36,340    | —      | 2,973    | 39,478    | —       |
| 58-59 | 6,930    | 34,570    | —      | 5,038    | 37,681    | —       |
| 59-60 | 2,183    | 32,845    | —      | 1,821    | 35,926    | —       |
| 60-61 | 165,007  | 31,167    | 16,840 | 204,810  | 34,211    | 170,599 |
| 61-62 | 1,954    | 29,534    | —      | 1,354    | 32,538    | —       |
| 62-63 | 4,912    | 27,947    | —      | 3,474    | 30,906    | —       |
| 63-64 | 3,373    | 26,406    | —      | 2,128    | 29,313    | —       |
| 64-65 | 2,091    | 24,911    | —      | 1,332    | 27,764    | —       |
| 65-66 | 60,661   | 23,461    | 37,200 | 56,268   | 26,254    | 30,014  |
| 66-67 | 1,436    | 22,056    | —      | 854      | 24,787    | —       |
| 67-68 | 2,118    | 20,694    | —      | 1,428    | 23,360    | —       |
| 68-69 | 2,333    | 19,384    | —      | 1,969    | 21,974    | —       |
| 69-70 | 762      | 18,113    | —      | 716      | 20,631    | —       |
| 70-71 | 89,766   | 16,888    | 72,878 | 110,158  | 19,328    | 90,830  |
| 71-72 | 754      | 15,710    | —      | 699      | 18,068    | —       |
| 72-73 | 1,784    | 14,574    | —      | 1,539    | 16,848    | —       |
| 73-74 | 827      | 13,483    | —      | 675      | 15,671    | —       |
| 74-75 | 493      | 12,436    | —      | 360      | 14,535    | —       |
| 75-76 | 24,829   | 11,435    | 13,394 | 22,972   | 13,441    | 9,531   |

|       |        |        |        |       |        |        |        |        |
|-------|--------|--------|--------|-------|--------|--------|--------|--------|
| 76-77 | 522    | 10,475 | —      | 9,953 | 403    | 12,388 | —      | 11,985 |
| 77-78 | 475    | 9,561  | —      | 9,086 | 357    | 11,379 | —      | 11,022 |
| 78-79 | 655    | 8,690  | —      | 8,035 | 565    | 10,410 | —      | 9,845  |
| 79-80 | 305    | 7,862  | —      | 7,557 | 305    | 9,484  | —      | 9,179  |
| 80-81 | 38,228 | 7,078  | 31,150 | —     | 55,668 | 8,600  | 47,068 | —      |
| 81-82 | 282    | 6,336  | —      | 6,054 | 315    | 7,758  | —      | 7,443  |
| 82-83 | 502    | 5,637  | —      | 5,135 | 494    | 6,960  | —      | 6,466  |
| 83-84 | 241    | 4,981  | —      | 4,740 | 200    | 6,202  | —      | 6,002  |
| 84-85 | 195    | 4,366  | —      | 4,171 | 157    | 5,489  | —      | 5,332  |
| 85-86 | 6,872  | 3,796  | 3,076  | —     | 7,042  | 4,817  | 2,225  | —      |
| 86-87 | 163    | 3,265  | —      | 3,102 | 124    | 4,189  | —      | 4,065  |
| 87-88 | 222    | 2,777  | —      | 2,555 | 189    | 3,603  | —      | 3,414  |
| 88-89 | 136    | 2,329  | —      | 2,193 | 142    | 3,061  | —      | 2,919  |
| 89-90 | 93     | 1,923  | —      | 1,830 | 101    | 2,562  | —      | 2,461  |
| 90-91 | 11,662 | 1,556  | 10,106 | —     | 15,427 | 2,106  | 13,321 | —      |
| 91-92 | 81     | 1,232  | —      | 1,151 | 87     | 1,695  | —      | 1,608  |
| 92-93 | 128    | 945    | —      | 817   | 126    | 1,326  | —      | 1,200  |
| 93-94 | 61     | 698    | —      | 637   | 67     | 1,003  | —      | 936    |
| 94-95 | 42     | 490    | —      | 448   | 29     | 724    | —      | 695    |
| 95-96 | 2,281  | —      | —      | —     | 2,192  | 488    | 1,704  | —      |

TABLE No. 10.—SHOWING THE GRADUATED NUMBERS OF MALES IN 1927, WHOSE AGES END WITH EACH OF THE TEN UNIT DIGITS.

| Tens Digit of Age | Units Digit of Age |         |         |         |         |         |         |         |         |         |
|-------------------|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                   | 0                  | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       |
| 0 ... ..          | 216,281            | 211,754 | 207,272 | 202,839 | 198,464 | 194,128 | 189,850 | 185,620 | 181,434 | 177,304 |
| 10 ... ..         | 173,227            | 169,190 | 165,211 | 161,277 | 154,384 | 153,559 | 149,773 | 146,042 | 142,352 | 138,716 |
| 20 ... ..         | 153,130            | 131,593 | 128,099 | 124,661 | 121,267 | 117,926 | 114,634 | 111,387 | 108,191 | 105,042 |
| 30 ... ..         | 101,940            | 98,892  | 95,890  | 92,936  | 90,029  | 87,169  | 84,361  | 81,601  | 78,885  | 76,220  |
| 40 ... ..         | 73,599             | 71,037  | 68,509  | 66,035  | 63,609  | 61,228  | 58,896  | 56,609  | 54,374  | 52,181  |
| 50 ... ..         | 50,038             | 47,942  | 45,891  | 43,888  | 41,931  | 40,022  | 38,158  | 36,340  | 34,570  | 32,843  |
| 60 ... ..         | 31,167             | 29,534  | 27,947  | 26,406  | 24,911  | 23,461  | 22,056  | 20,694  | 19,384  | 18,113  |
| 70 ... ..         | 16,888             | 15,710  | 14,574  | 13,483  | 12,436  | 11,435  | 10,475  | 9,561   | 8,690   | 7,862   |
| 80 ... ..         | 7,078              | 6,336   | 5,637   | 4,981   | 4,366   | 3,796   | 3,265   | 2,777   | 2,329   | 1,923   |
| 90 ... ..         | 1,556              | 1,232   | 945     | 698     | 490     | 340     | 231     | 119     | 40      | 4       |
| TOTALS ... ..     | 806,904            | 783,220 | 759,975 | 737,204 | 714,897 | 693,064 | 671,699 | 650,750 | 630,249 | 610,210 |
| Per cent ... ..   | 114                | 111     | 108     | 104     | 101     | 98      | 95      | 92      | 89      | 86      |

TABLE No. 11.—SHOWING THE GRADUATED NUMBERS OF FEMALES IN 1927, WHOSE AGES END WITH EACH OF THE TEN UNIT DIGITS.

| Tens Digit of Age | Units Digit of Age |         |         |         |         |         |         |         |         |         |
|-------------------|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                   | 0                  | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       |
| 0 ... ..          | 208,396            | 204,309 | 200,291 | 196,283 | 192,335 | 188,406 | 184,527 | 180,689 | 176,886 | 173,134 |
| 10 ... ..         | 169,404            | 165,725 | 162,080 | 158,479 | 154,916 | 151,393 | 147,907 | 144,462 | 141,058 | 137,699 |
| 20 ... ..         | 134,368            | 131,079 | 127,839 | 124,628 | 121,468 | 118,335 | 115,251 | 112,205 | 109,197 | 106,232 |
| 30 ... ..         | 103,299            | 100,420 | 97,567  | 94,762  | 91,994  | 89,263  | 86,582  | 83,936  | 81,329  | 78,762  |
| 40 ... ..         | 76,236             | 73,751  | 71,305  | 68,899  | 66,534  | 64,210  | 61,926  | 59,683  | 57,479  | 55,317  |
| 50 ... ..         | 53,195             | 51,113  | 49,072  | 47,071  | 45,112  | 43,194  | 41,315  | 39,478  | 37,681  | 35,926  |
| 60 ... ..         | 34,211             | 32,538  | 30,906  | 29,313  | 27,764  | 26,254  | 24,787  | 23,360  | 21,974  | 20,631  |
| 70 ... ..         | 19,328             | 18,068  | 16,848  | 15,671  | 14,535  | 13,441  | 12,388  | 11,379  | 10,410  | 9,484   |
| 80 ... ..         | 8,600              | 7,758   | 6,960   | 6,202   | 5,489   | 4,817   | 4,189   | 3,603   | 3,061   | 2,562   |
| 90 ... ..         | 2,106              | 1,695   | 1,326   | 1,003   | 724     | 488     | 300     | 155     | 59      | 8       |
| TOTALS ... ..     | 809,143            | 786,456 | 764,196 | 742,311 | 720,871 | 699,806 | 679,172 | 658,950 | 639,134 | 619,755 |
| Per cent ... ..   | 114                | 110     | 107     | 104     | 101     | 98      | 95      | 93      | 90      | 87      |

TABLE No. 12.—SHOWING THE AMOUNT OF ERRORS IN AGES ENDING WITH EACH OF THE TEN UNIT DIGITS (MALES) 1927.

| Tens Digit of Age | Units Digit of Age, |          |         |          |          |         |          |          |         |          |
|-------------------|---------------------|----------|---------|----------|----------|---------|----------|----------|---------|----------|
|                   | 0                   | 1        | 2       | 3        | 4        | 5       | 6        | 7        | 8       | 9        |
| 0...              | 32,885              | —84,292  | 42      | 5,911    | 3,305    | 28,913  | 9,668    | 30,130   | 78,733  | —78,087  |
| 10...             | 109,049             | —112,715 | 128,540 | —51,910  | —38,770  | 86,534  | —44,836  | —53,642  | 12,246  | —50,631  |
| 20...             | 57,078              | —60,761  | —5,545  | —46,913  | —61,902  | 209,995 | —60,128  | —39,418  | —9,503  | —84,581  |
| 30...             | 270,467             | —82,902  | 33,807  | —66,862  | 72,254   | 292,330 | —61,091  | —52,880  | —28,689 | —64,534  |
| 40...             | 251,257             | —63,476  | —42,684 | —53,085  | —56,836  | 175,781 | —48,966  | —44,678  | —34,670 | —46,786  |
| 50...             | 193,134             | —43,884  | —34,724 | —38,150  | —35,498  | 61,424  | —32,943  | —31,351  | —27,640 | —30,662  |
| 60...             | 133,840             | —27,580  | 23,035  | —23,033  | —22,820  | 37,200  | —20,620  | —18,576  | —17,051 | —17,351  |
| 70...             | 72,878              | —14,956  | —12,790 | —12,656  | —11,943  | 13,394  | —9,953   | —9,086   | —8,035  | —7,557   |
| 80...             | 31,150              | —6,054   | —5,135  | —4,740   | —4,171   | 3,076   | —3,102   | —2,555   | —2,193  | —1,830   |
| 90...             | 10,106              | —1,151   | 817     | 637      | —448     | 1,941   | —        | —        | —       | —        |
| TOTALS            | 1,161,844           | —497,771 | —29,965 | —292,075 | —301,337 | 910,588 | —271,971 | —282,316 | —36,802 | —382,019 |
| Per cent          | 144                 | —64      | —4      | —40      | —42      | 131     | —41      | —43      | —6      | —63      |

TABLE No. 13.—SHOWING THE AMOUNT OF ERRORS IN AGES ENDING WITH EACH OF THE TEN UNIT DIGITS (FEMALES) 1927.

| Tens Digit of Age | Units Digit of Age |          |          |          |          |         |          |          |         |          |
|-------------------|--------------------|----------|----------|----------|----------|---------|----------|----------|---------|----------|
|                   | 0                  | 1        | 2        | 3        | 4        | 5       | 6        | 7        | 8       | 9        |
| 0...              | 35,389             | 69,168   | 20,836   | 27,446   | 20,117   | 35,221  | 19,628   | —        | 31,329  | 72,354   |
| 10...             | 75,160             | —117,175 | 66,520   | —68,169  | —47,545  | 34,714  | —35,967  | —66,072  | 46,354  | —86,820  |
| 20...             | 218,922            | —101,979 | —26,387  | —75,028  | —77,644  | 345,393 | —80,679  | —63,225  | —17,835 | 92,249   |
| 30...             | 382,964            | —90,976  | —50,912  | —78,593  | —79,466  | 277,638 | —72,793  | —66,969  | —44,644 | —70,648  |
| 40...             | 300,104            | —69,001  | —53,753  | —60,027  | —62,469  | 149,281 | —56,906  | —53,260  | —43,725 | —51,133  |
| 50...             | 232,174            | —48,428  | —41,669  | —43,460  | —41,108  | 50,472  | —38,400  | —36,506  | —32,643 | —34,105  |
| 60...             | 170,599            | —31,184  | —27,432  | —27,185  | —26,432  | 30,014  | —23,933  | —21,932  | —20,005 | —19,915  |
| 70...             | 90,830             | —17,369  | —15,309  | —14,096  | —14,175  | 9,531   | —11,985  | —11,022  | —9,845  | —9,179   |
| 80...             | 47,068             | —7,443   | —6,466   | —6,002   | —4,332   | 2,225   | —4,065   | —3,414   | —2,919  | —2,461   |
| 90...             | 13,321             | —1,608   | —1,200   | —939     | —695     | 1,704   | —        | —        | —       | —        |
| TOTALS...         | 1566,531           | —554,331 | —135,772 | —346,950 | —334,749 | 936,193 | —305,100 | —353,729 | —52,908 | —444,268 |
| Per cent ...      | 191                | —70      | —18      | —47      | —45      | 134     | —45      | —54      | —8      | —72      |

TABLE NO. 14.—ERRORS PER CENT IN RETURNS OF AGE—CENSUS 1927—(MALES).

| Tens Digit of Age | Units Digit of Age |     |     |     |     |     |     |     |     |     |
|-------------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                   | 0                  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   |
| 0 ... ..          | 15                 | —40 | 0   | 3   | 2   | 14  | 5   | —6  | 43  | —44 |
| 10 ... ..         | 63                 | —66 | 78  | —32 | —25 | 56  | 30  | 37  | 9   | —4  |
| 20 ... ..         | 42                 | —45 | —4  | —38 | —51 | 178 | —52 | —35 | —9  | —81 |
| 30 ... ..         | 265                | —84 | —35 | —72 | —80 | 335 | —72 | —65 | —36 | —85 |
| 40 ... ..         | 341                | —89 | —62 | —80 | —89 | 287 | —83 | —79 | —64 | —90 |
| 50 ... ..         | 386                | —92 | —76 | —87 | —85 | 153 | —86 | —86 | —80 | —93 |
| 60 ... ..         | 424                | —93 | —82 | —87 | —92 | 159 | —93 | —90 | —88 | —96 |
| 70 ... ..         | 432                | —95 | —88 | —94 | —96 | 117 | —95 | —95 | —93 | —96 |
| 80 ... ..         | 440                | —96 | —91 | —95 | —96 | 81  | —95 | —92 | —94 | —95 |
| 90 ... ..         | 649                | —93 | —86 | —91 | —91 | —   | —   | —   | —   | —   |

TABLE NO. 15.—ERRORS PER CENT IN RETURNS OF AGE—CENSUS 1927—(FEMALES).

| Tens Digit of age | Units Digit of Age |     |     |     |     |     |     |     |     |     |
|-------------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                   | 0                  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   |
| 0 ... ..          | 17                 | -34 | 10  | 14  | 10  | 19  | 11  | -17 | 41  | -45 |
| 10 ... ..         | 44                 | -71 | 41  | -43 | -31 | 23  | -24 | -46 | 33  | -63 |
| 20 ... ..         | 163                | -78 | -21 | -60 | -64 | 292 | -70 | -56 | -16 | -87 |
| 30 ... ..         | 371                | -91 | -52 | -83 | -86 | 311 | -84 | -80 | -55 | -90 |
| 40 ... ..         | 394                | -94 | -75 | -87 | -94 | 232 | -92 | -89 | -76 | -92 |
| 50 ... ..         | 436                | -95 | -85 | -92 | -91 | 117 | -93 | -92 | -87 | -95 |
| 60 ... ..         | 499                | -96 | -89 | -93 | -95 | 114 | -97 | -94 | -91 | -97 |
| 70 ... ..         | 470                | -96 | -91 | -96 | -98 | 71  | -97 | -97 | -95 | -97 |
| 80 ... ..         | 547                | -96 | -93 | -97 | -97 | 46  | -97 | -95 | -95 | -96 |
| 90 ... ..         | 633                | -95 | -90 | -93 | -96 | —   | —   | —   | —   | —   |

TABLE No. 16.—MORTALITY PER CENT "100 q<sub>x</sub>" OF EACH SEX IN THE FOLLOWING COUNTRIES.

| Age<br>x<br>(1) | Egypt 1927   |                | India 1901-1911 |                | Lagos 1921-1930 |                | England No. 9 |                |
|-----------------|--------------|----------------|-----------------|----------------|-----------------|----------------|---------------|----------------|
|                 | Males<br>(2) | Females<br>(3) | Males<br>(4)    | Females<br>(5) | Males<br>(6)    | Females<br>(7) | Males<br>(8)  | Females<br>(9) |
| 10              | 1.281        | .987           | 1.25            | 1.29           | .825            | Not Computed.  | .181          | .180           |
| 11              | 1.298        | 1.003          | 1.20            | 1.24           | .832            |                | .173          | .180           |
| 12              | 1.313        | 1.018          | 1.19            | 1.23           | .823            |                | .175          | .187           |
| 13              | 1.331        | 1.035          | 1.22            | 1.24           | .815            |                | .184          | .200           |
| 14              | 1.348        | 1.052          | 1.26            | 1.28           | .821            |                | .199          | .214           |
| 15              | 1.368        | 1.070          | 1.32            | 1.34           | .828            |                | .218          | .227           |
| 16              | 1.388        | 1.089          | 1.40            | 1.41           | .851            |                | .246          | .243           |
| 17              | 1.407        | 1.109          | 1.47            | 1.48           | .858            |                | .278          | .261           |
| 18              | 1.429        | 1.130          | 1.55            | 1.56           | .882            |                | .308          | .279           |
| 19              | 1.451        | 1.151          | 1.62            | 1.63           | .873            |                | .332          | .294           |
| 20              | 1.475        | 1.174          | 1.69            | 1.70           | .914            |                | .349          | .306           |
| 21              | 1.499        | 1.197          | 1.76            | 1.76           | .939            |                | .363          | .316           |
| 22              | 1.525        | 1.222          | 1.82            | 1.82           | .964            |                | .374          | .325           |
| 23              | 1.552        | 1.247          | 1.89            | 1.88           | .990            |                | .383          | .333           |
| 24              | 1.580        | 1.274          | 1.96            | 1.94           | 1.017           |                | .392          | .342           |
| 25              | 1.611        | 1.302          | 2.03            | 2.00           | 1.045           |                | .398          | .350           |
| 26              | 1.639        | 1.331          | 2.10            | 2.06           | 1.073           |                | .401          | .358           |
| 27              | 1.671        | 1.361          | 2.16            | 2.12           | 1.137           |                | .403          | .365           |
| 28              | 1.706        | 1.393          | 2.23            | 2.18           | 1.150           |                | .408          | .373           |
| 29              | 1.740        | 1.426          | 2.30            | 2.24           | 1.199           |                | .418          | .382           |
| 30              | 1.776        | 1.461          | 2.35            | 2.31           | 1.232           |                | .434          | .392           |
| 31              | 1.815        | 1.497          | 2.44            | 2.37           | 1.266           |                | .455          | .402           |
| 32              | 1.854        | 1.535          | 2.52            | 2.44           | 1.300           |                | .476          | .414           |

|    |     |       |       |      |      |       |       |       |
|----|-----|-------|-------|------|------|-------|-------|-------|
| 33 | ... | 1 898 | 1 575 | 2 61 | 2 51 | 1 336 | 504   | 425   |
| 34 | ... | 1 939 | 1 616 | 2 69 | 2 58 | 1 374 | 529   | 438   |
| 35 | ... | 1 986 | 1 659 | 2 78 | 2 66 | 1 412 | 553   | 451   |
| 36 | ... | 2 034 | 1 703 | 2 87 | 2 74 | 1 432 | 576   | 464   |
| 37 | ... | 2 084 | 1 751 | 2 96 | 2 82 | 1 473 | 600   | 478   |
| 38 | ... | 2 135 | 1 800 | 3 05 | 2 90 | 1 515 | 627   | 494   |
| 39 | ... | 2 191 | 1 851 | 3 14 | 2 99 | 1 539 | 656   | 512   |
| 40 | ... | 2 246 | 1 903 | 3 23 | 3 09 | 1 604 | 688   | 532   |
| 41 | ... | 2 306 | 1 962 | 3 32 | 3 18 | 1 630 | 722   | 553   |
| 42 | ... | 2 359 | 2 018 | 3 42 | 3 27 | 1 679 | 758   | 575   |
| 43 | ... | 2 450 | 2 082 | 3 52 | 3 36 | 1 730 | 797   | 602   |
| 44 | ... | 2 497 | 2 145 | 3 61 | 3 45 | 1 760 | 839   | 633   |
| 45 | ... | 2 578 | 2 211 | 3 72 | 3 53 | 1 837 | 881   | 668   |
| 46 | ... | 2 647 | 2 281 | 3 82 | 3 63 | 1 897 | 922   | 706   |
| 47 | ... | 2 735 | 2 359 | 3 93 | 3 72 | 1 978 | 968   | 748   |
| 48 | ... | 2 806 | 2 435 | 4 04 | 3 83 | 2 042 | 1 024 | 796   |
| 49 | ... | 2 910 | 2 512 | 4 16 | 3 94 | 2 158 | 1 093 | 851   |
| 50 | ... | 2 986 | 2 599 | 4 28 | 4 06 | 2 281 | 1 179 | 915   |
| 51 | ... | 3 089 | 2 694 | 4 40 | 4 18 | 2 385 | 1 280 | 987   |
| 52 | ... | 3 179 | 2 782 | 4 54 | 4 31 | 2 444 | 1 391 | 1 064 |
| 53 | ... | 3 309 | 2 884 | 4 68 | 4 44 | 2 559 | 1 510 | 1 147 |
| 54 | ... | 3 402 | 2 986 | 4 83 | 4 58 | 2 709 | 1 633 | 1 234 |
| 55 | ... | 3 522 | 3 095 | 4 99 | 4 74 | 2 841 | 1 755 | 1 319 |
| 56 | ... | 3 648 | 3 210 | 5 15 | 4 91 | 2 963 | 1 879 | 1 403 |
| 57 | ... | 3 786 | 3 337 | 5 34 | 5 09 | 3 195 | 2 013 | 1 495 |
| 58 | ... | 3 912 | 3 466 | 5 54 | 5 30 | 3 425 | 2 165 | 1 603 |
| 59 | ... | 4 078 | 3 591 | 5 75 | 5 52 | 3 611 | 2 246 | 1 736 |
| 60 | ... | 4 209 | 3 737 | 5 98 | 5 78 | 3 746 | 2 561 | 1 897 |
| 61 | ... | 4 381 | 3 896 | 6 24 | 6 06 | 4 065 | 2 804 | 2 081 |
| 62 | ... | 4 542 | 4 048 | 6 53 | 6 35 | 4 383 | 3 072 | 2 287 |
| 63 | ... | 4 751 | 4 222 | 6 83 | 6 68 | 4 697 | 3 360 | 2 510 |
| 64 | ... | 4 918 | 4 399 | 7 17 | 7 04 | 5 008 | 3 663 | 2 747 |
| 65 | ... | 5 131 | 4 586 | 7 55 | 7 44 | 5 607 | 3 975 | 2 992 |

TABLE No. 10.—MORTALITY PER CENT "100 Q<sub>x</sub>" OF EACH SEX IN THE FOLLOWING COUNTRIES (contd.).

| Age<br>x<br>(1) | Egypt 1927   |                | India, 1901-1911 |                | Lagos 1921-1930 |                | England No. 9 |                |
|-----------------|--------------|----------------|------------------|----------------|-----------------|----------------|---------------|----------------|
|                 | Males<br>(2) | Females<br>(3) | Males<br>(4)     | Females<br>(5) | Males<br>(6)    | Females<br>(7) | Males<br>(8)  | Females<br>(9) |
| 66              | 5.364        | 4.793          | 7.98             | 7.88           | 5.674           | Not Computed   | 4.298         | 3.246          |
| 67              | 5.586        | 5.017          | 8.43             | 8.36           | 5.874           |                | 4.647         | 3.523          |
| 68              | 5.808        | 5.242          | 8.95             | 8.89           | 6.141           |                | 5.037         | 3.839          |
| 69              | 6.118        | 5.478          | 9.55             | 9.48           | 6.383           |                | 5.482         | 4.209          |
| 70              | 6.369        | 5.747          | 10.17            | 10.12          | 6.050           |                | 5.997         | 4.646          |
| 71              | 6.682        | 6.033          | 10.91            | 10.82          | 7.273           |                | 6.577         | 5.145          |
| 72              | 7.002        | 6.319          | 11.73            | 11.63          | 7.843           |                | 7.215         | 5.699          |
| 73              | 7.371        | 6.657          | 12.63            | 12.51          | 8.511           |                | 7.900         | 6.297          |
| 74              | 7.720        | 7.001          | 13.66            | 13.50          | 9.302           |                | 8.620         | 6.928          |
| 75              | 8.145        | 7.370          | 14.80            | 14.60          | 9.402           |                | 9.379         | 7.594          |
| 76              | 8.586        | 7.780          | 16.09            | 15.83          | 11.321          |                | 10.192        | 8.308          |
| 77              | 9.041        | 8.226          | 17.48            | 17.22          | 11.702          |                | 11.057        | 9.074          |
| 78              | 9.544        | 8.711          | 19.14            | 18.89          | 13.252          |                | 11.977        | 9.898          |
| 79              | 10.146       | 9.220          | 20.92            | 20.52          | 13.889          |                | 12.952        | 10.786         |
| 80              | 10.734       | 9.792          | 22.87            | 22.49          | 14.516          |                | 14.002        | 11.766         |
| 81              | 11.413       | 10.422         | 25.13            | 24.69          | 16.981          |                | 15.136        | 12.847         |
| 82              | 12.163       | 11.109         | 27.52            | 27.16          | 15.909          |                | 16.334        | 14.000         |
| 83              | 13.009       | 11.881         | 30.09            | 29.90          | 18.919          |                | 17.569        | 15.194         |
| 84              | 13.893       | 12.743         | 33.11            | 32.90          | 20.000          |                | 18.812        | 16.386         |
| 85              | 14.902       | 13.693         | 36.63            | 36.28          | 20.833          |                | 19.974        | 17.465         |
| 86              | 16.117       | 14.738         | 39.84            | 39.93          | 26.316          |                | 21.198        | 18.607         |
| 87              | 17.359       | 15.984         | 42.86            | 44.00          | 21.429          |                | 22.486        | 19.814         |
| 88              | 18.878       | 17.374         | 47.73            | 48.50          | 27.273          |                | 23.840        | 21.089         |

|     |     |         |         |        |       |        |               |        |        |
|-----|-----|---------|---------|--------|-------|--------|---------------|--------|--------|
| 89  | ... | 20·601  | 18·998  | 52·17  | 53·50 | 25·000 | Not Computed. | 25·262 | 22·434 |
| 90  | ... | 22·643  | 20·835  | 54·55  | 59·07 | 33·333 |               | 26·752 | 23·852 |
| 91  | ... | 24·922  | 23·058  | 60·00  | 65·30 | 25·333 |               | 28·313 | 25·343 |
| 92  | ... | 27·921  | 25·857  | 50·00  | 72·39 | 33·333 |               | 29·945 | 26·910 |
| 93  | ... | 31·564  | 29·076  | 100·00 | 80·34 | 50·000 |               | 31·648 | 28·554 |
| 94  | ... | 35·849  | 33·412  | —      | —     | —      |               | 33·424 | 30·277 |
| 95  | ... | 41·503  | 40·968  | —      | —     | —      |               | 35·272 | 32·078 |
| 96  | ... | 50·280  | 46·356  | —      | —     | —      |               | 37·190 | 33·959 |
| 97  | ... | 61·798  | 57·609  | —      | —     | —      |               | 39·179 | 35·918 |
| 98  | ... | 79·412  | 74·359  | —      | —     | —      |               | 41·235 | 37·955 |
| 99  | ... | 85·714  | 95·000  | —      | —     | —      |               | 43·357 | 40·068 |
| 100 | ... | 100·000 | 100·000 | —      | —     | —      |               | 45·542 | 42·254 |
| 101 | ... | —       | —       | —      | —     | —      |               | 47·784 | 44·510 |
| 102 | ... | —       | —       | —      | —     | —      |               | 50·079 | 46·833 |
| 103 | ... | —       | —       | —      | —     | —      |               | 52·421 | 49·216 |
| 104 | ... | —       | —       | —      | —     | —      |               | 54·804 | 51·653 |
| 105 | ... | —       | —       | —      | —     | —      |               | 57·220 | 54·137 |

TABLE No. 17.—COMPARATIVE EXPECTATION OF LIFE AT QUINQUENNIAL AGES, IN EGYPT, INDIA, LAGOS AND ENGLAND.

| Age | Egypt 1917-1927 |         | India 1901-1911 |         | Lagos 1921-1930 |         | England No. 9 |         | Age  |
|-----|-----------------|---------|-----------------|---------|-----------------|---------|---------------|---------|------|
|     | Males           | Females | Males           | Females | Males           | Females | Males         | Females |      |
| 10  | 38.06           | 41.64   | 33.36           | 33.74   | 43.7            |         | 54.64         | 57.53   | 10   |
| 15  | 35.49           | 38.69   | 30.32           | 30.78   | 40.5            |         | 50.12         | 53.06   | 15   |
| 20  | 32.92           | 35.77   | 27.46           | 27.96   | 37.1            |         | 45.78         | 48.73   | 20   |
| 25  | 30.35           | 32.88   | 24.86           | 25.40   | 33.8            |         | 41.60         | 44.48   | 25   |
| 30  | 27.80           | 30.04   | 22.44           | 22.99   | 30.7            |         | 37.40         | 40.26   | 30   |
| 35  | 25.28           | 27.25   | 20.16           | 20.69   | 27.6            |         | 33.25         | 36.05   | 35   |
| 40  | 22.82           | 24.53   | 18.02           | 18.49   | 24.5            |         | 29.19         | 31.86   | 40   |
| 45  | 20.41           | 21.90   | 15.97           | 16.38   | 21.4            |         | 25.22         | 27.73   | 45   |
| 50  | 18.07           | 19.36   | 13.97           | 14.28   | 18.4            |         | 21.36         | 23.69   | 50   |
| 55  | 15.81           | 16.92   | 11.99           | 12.20   | 15.6            |         | 17.73         | 19.86   | 55   |
| 60  | 13.65           | 14.58   | 10.00           | 10.11   | 12.9            |         | 14.36         | 16.22   | 60   |
| 65  | 11.58           | 12.37   | 8.04            | 8.10    | 10.5            |         | 11.36         | 12.90   | 65   |
| 70  | 9.63            | 10.27   | 6.17            | 6.22    | 8.3             |         | 8.75          | 9.95    | 70   |
| 75  | 7.78            | 8.30    | 4.47            | 4.52    | 6.3             |         | 6.59          | 7.49    | 75   |
| 80  | 6.05            | 6.45    | 3.04            | 3.06    | 4.6             |         | 4.93          | 5.55    | 80   |
| 85  | 4.44            | 4.74    | 1.94            | 1.93    | 3.4             |         | 3.72          | 4.16    | 85   |
| 90  | 2.93            | 3.13    | 1.23            | 1.10    | 2.3             |         | 2.82          | 3.13    | 90   |
| 95  | 1.51            | 1.62    | —               | —       | .5              |         | 2.12          | 2.33    | 95   |
| 100 | .50             | .50     | —               | —       | —               |         | 1.59          | 1.73    | 100. |

Not Computed.



TABLE No. 18.  
Males (1917-1927).

| Age<br>x | $l_x$   | $d_x$ | $p_x$  | $q_x$  | $L_x$  | $e_x$ | Age<br>x |
|----------|---------|-------|--------|--------|--------|-------|----------|
| 10       | 100,000 | 1,281 | .98719 | .01281 | 99,360 | 38.06 | 10       |
| 11       | 98,719  | 1,281 | .98702 | .01298 | 98,079 | 37.55 | 11       |
| 12       | 97,438  | 1,279 | .98687 | .01313 | 96,799 | 37.03 | 12       |
| 13       | 96,159  | 1,280 | .98669 | .01331 | 95,519 | 36.52 | 13       |
| 14       | 94,879  | 1,279 | .98652 | .01348 | 94,240 | 36.01 | 14       |
| 15       | 93,600  | 1,280 | .98632 | .01368 | 92,960 | 35.49 | 15       |
| 16       | 92,320  | 1,281 | .98612 | .01388 | 91,680 | 34.98 | 16       |
| 17       | 91,039  | 1,281 | .98593 | .01407 | 90,399 | 34.46 | 17       |
| 18       | 89,758  | 1,283 | .98571 | .01429 | 89,117 | 33.95 | 18       |
| 19       | 88,475  | 1,284 | .98549 | .01451 | 87,833 | 33.43 | 19       |
| 20       | 87,191  | 1,288 | .98525 | .01475 | 86,547 | 32.92 | 20       |
| 21       | 85,903  | 1,289 | .98501 | .01499 | 85,259 | 32.40 | 21       |
| 22       | 84,614  | 1,287 | .98475 | .01525 | 83,971 | 31.89 | 22       |
| 23       | 83,327  | 1,295 | .98448 | .01552 | 82,680 | 31.37 | 23       |
| 24       | 82,032  | 1,295 | .98420 | .01580 | 81,385 | 30.86 | 24       |
| 25       | 80,737  | 1,298 | .98389 | .01611 | 80,088 | 29.83 | 25       |
| 26       | 79,439  | 1,292 | .98361 | .01639 | 78,788 | 29.35 | 26       |
| 27       | 78,137  | 1,306 | .98329 | .01671 | 77,484 | 29.32 | 27       |
| 28       | 76,831  | 1,301 | .98294 | .01706 | 76,176 | 28.81 | 28       |
| 29       | 75,520  | 1,316 | .98260 | .01740 | 74,862 | 28.31 | 29       |
| 30       | 74,204  | 1,320 | .98224 | .01776 | 73,544 | 27.80 | 30       |
| 31       | 72,884  | 1,322 | .98185 | .01815 | 72,223 | 27.29 | 31       |
| 32       | 71,562  | 1,322 | .98146 | .01854 | 70,901 | 26.79 | 32       |
| 33       | 70,240  | 1,336 | .98102 | .01898 | 69,572 | 26.28 | 33       |

|    |        |       |        |        |        |       |
|----|--------|-------|--------|--------|--------|-------|
| 34 | 68,904 | 1,336 | .98461 | .01939 | 68,236 | 25.78 |
| 35 | 67,568 | 1,342 | .98014 | .01986 | 66,897 | 25.28 |
| 36 | 66,226 | 1,344 | .97966 | .02034 | 65,554 | 24.78 |
| 37 | 64,882 | 1,355 | .97916 | .02084 | 64,070 | 24.28 |
| 38 | 63,527 | 1,353 | .97864 | .02136 | 62,716 | 23.79 |
| 39 | 62,174 | 1,365 | .97809 | .02191 | 61,492 | 23.31 |
| 40 | 60,809 | 1,366 | .97754 | .02246 | 60,126 | 22.82 |
| 41 | 59,443 | 1,371 | .97694 | .02306 | 58,758 | 22.33 |
| 42 | 58,072 | 1,370 | .97641 | .02359 | 57,387 | 21.85 |
| 43 | 56,702 | 1,389 | .97550 | .02450 | 56,008 | 21.36 |
| 44 | 55,313 | 1,381 | .97503 | .02497 | 54,623 | 20.89 |
| 45 | 53,932 | 1,390 | .97422 | .02578 | 53,237 | 20.41 |
| 46 | 52,542 | 1,391 | .97353 | .02647 | 51,847 | 19.93 |
| 47 | 51,151 | 1,391 | .97265 | .02735 | 50,452 | 19.46 |
| 48 | 49,752 | 1,399 | .97194 | .02806 | 49,054 | 19.00 |
| 49 | 48,356 | 1,407 | .97090 | .02910 | 47,653 | 18.53 |
| 50 | 46,919 | 1,402 | .97014 | .02986 | 46,248 | 18.07 |
| 51 | 45,547 | 1,407 | .96911 | .03089 | 44,844 | 17.61 |
| 52 | 44,140 | 1,403 | .96821 | .03179 | 43,439 | 17.16 |
| 53 | 42,737 | 1,414 | .96691 | .03309 | 42,030 | 16.70 |
| 54 | 41,323 | 1,406 | .96598 | .03402 | 40,620 | 16.26 |
| 55 | 39,917 | 1,406 | .96478 | .03522 | 39,214 | 15.81 |
| 56 | 38,511 | 1,405 | .96352 | .03648 | 37,809 | 15.37 |
| 57 | 37,106 | 1,405 | .96214 | .03786 | 36,404 | 14.94 |
| 58 | 35,701 | 1,393 | .96088 | .03912 | 35,005 | 14.50 |
| 59 | 34,308 | 1,399 | .95922 | .04078 | 33,609 | 14.07 |
| 60 | 32,909 | 1,385 | .95791 | .04209 | 32,217 | 13.65 |
| 61 | 31,524 | 1,381 | .95619 | .04381 | 30,834 | 13.23 |
| 62 | 30,143 | 1,369 | .95458 | .04542 | 29,459 | 12.81 |
| 63 | 28,774 | 1,367 | .95249 | .04751 | 28,091 | 12.40 |
| 64 | 27,407 | 1,348 | .95082 | .04918 | 26,733 | 11.99 |
| 65 | 26,059 | 1,337 | .94869 | .05131 | 25,391 | 11.58 |
| 66 | 24,722 | 1,326 | .95941 | .05364 | 24,059 | 11.18 |

TABLE NO. 18 (contd.).

## Egyptian Life-Table.

## Males (1917-1927).

| Age<br>x | $l_x$  | $d_x$ | $p_x$  | $q_x$  | $L_x$  | $e_x$ | Age<br>x |
|----------|--------|-------|--------|--------|--------|-------|----------|
| 67       | 23,396 | 1,307 | .94414 | .05586 | 22,743 | 10.79 | 67       |
| 68       | 22,089 | 1,283 | .94192 | .05808 | 21,448 | 10.40 | 68       |
| 69       | 20,806 | 1,273 | .93882 | .06118 | 20,170 | 10.01 | 69       |
| 70       | 19,533 | 1,244 | .93631 | .06369 | 18,911 | 9.63  | 70       |
| 71       | 18,289 | 1,222 | .93318 | .06682 | 17,678 | 9.25  | 71       |
| 72       | 17,067 | 1,195 | .92998 | .07002 | 16,480 | 8.87  | 72       |
| 73       | 15,872 | 1,170 | .92629 | .07371 | 15,287 | 8.50  | 73       |
| 74       | 14,702 | 1,135 | .92280 | .07720 | 14,135 | 8.14  | 74       |
| 75       | 13,567 | 1,105 | .91855 | .08145 | 13,015 | 7.78  | 75       |
| 76       | 12,462 | 1,070 | .91414 | .08586 | 11,927 | 7.42  | 76       |
| 77       | 11,392 | 1,030 | .90959 | .09041 | 10,877 | 7.08  | 77       |
| 78       | 10,362 | 989   | .90456 | .09544 | 9,868  | 6.73  | 78       |
| 79       | 9,373  | 951   | .89854 | .10146 | 8,898  | 6.39  | 79       |
| 80       | 8,422  | 904   | .89266 | .10734 | 7,970  | 6.05  | 80       |
| 81       | 7,518  | 858   | .88587 | .11413 | 7,089  | 5.72  | 81       |
| 82       | 6,660  | 810   | .87837 | .12163 | 6,255  | 5.39  | 82       |
| 83       | 5,850  | 761   | .86991 | .13009 | 5,470  | 5.07  | 83       |
| 84       | 5,089  | 707   | .86107 | .13893 | 4,736  | 4.75  | 84       |
| 85       | 4,383  | 653   | .85098 | .14902 | 4,051  | 4.44  | 85       |
| 86       | 3,729  | 601   | .83883 | .16117 | 3,429  | 4.12  | 86       |
| 87       | 3,128  | 543   | .82641 | .17359 | 2,857  | 3.83  | 87       |
| 88       | 2,585  | 488   | .81122 | .18878 | 2,341  | 3.52  | 88       |
| 89       | 2,097  | 432   | .79399 | .20601 | 1,881  | 3.22  | 89       |
| 90       | 1,665  | 377   | .77357 | .22643 | 1,477  | 2.93  | 90       |

|     |       |       |        |         |       |      |     |
|-----|-------|-------|--------|---------|-------|------|-----|
| 91  | 1,288 | 321   | .75078 | .24922  | 1,128 | 2.64 | 91  |
| 92  | 966.7 | 270   | .72079 | .27921  | 831.7 | 2.35 | 92  |
| 93  | 696.7 | 219.6 | .68436 | .31564  | 586.9 | 2.07 | 93  |
| 94  | 477.1 | 170.8 | .64151 | .35849  | 391.7 | 1.79 | 94  |
| 95  | 306.3 | 127.6 | .58497 | .41503  | 242.5 | 1.51 | 95  |
| 96  | 178.7 | 89.4  | .49720 | .50280  | 134.0 | 1.24 | 96  |
| 97  | 89.3  | 55.4  | .38202 | .61798  | 61.6  | .97  | 97  |
| 98  | 33.9  | 26.8  | .20588 | .79412  | 20.5  | .74  | 98  |
| 99  | 7.1   | 6.1   | .14286 | .85714  | 4.1   | .65  | 99  |
| 100 | 1.0   | 1.0   | .00000 | 1.00000 | 0.5   | .50  | 100 |

TABLE No. 19.

## Egyptian Life-Table.

## Females (1917-1927).

| Age<br>x | l <sub>x</sub> | d <sub>x</sub> | p <sub>x</sub> | q <sub>x</sub> | L <sub>x</sub> | e <sub>x</sub> | Age<br>x |
|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| 10       | 100,000        | 987            | .99013         | .00987         | 99,507         | 41.64          | 10       |
| 11       | 99,013         | 993            | .98997         | .01003         | 98,517         | 41.05          | 11       |
| 12       | 98,020         | 998            | .98982         | .01018         | 97,521         | 40.46          | 12       |
| 13       | 97,022         | 1,005          | .98965         | .01035         | 96,520         | 39.87          | 13       |
| 14       | 96,017         | 1,010          | .98948         | .01052         | 95,512         | 39.28          | 14       |
| 15       | 95,007         | 1,017          | .98930         | .01070         | 94,499         | 38.69          | 15       |
| 16       | 93,990         | 1,024          | .98911         | .01089         | 93,478         | 38.11          | 16       |
| 17       | 92,966         | 1,031          | .98891         | .01109         | 92,451         | 37.52          | 17       |
| 18       | 91,935         | 1,038          | .98870         | .01130         | 91,416         | 36.94          | 18       |
| 19       | 90,897         | 1,047          | .98849         | .01151         | 90,374         | 36.35          | 19       |
| 20       | 89,850         | 1,051          | .98826         | .01171         | 89,323         | 35.77          | 20       |
| 21       | 88,796         | 1,053          | .98803         | .01197         | 88,265         | 35.19          | 21       |
| 22       | 87,733         | 1,072          | .98778         | .01222         | 87,197         | 34.61          | 22       |
| 23       | 86,661         | 1,081          | .98753         | .01247         | 86,121         | 34.03          | 23       |
| 24       | 85,580         | 1,090          | .98726         | .01274         | 85,035         | 33.46          | 24       |
| 25       | 84,490         | 1,100          | .98698         | .01302         | 83,940         | 32.88          | 25       |
| 26       | 83,390         | 1,110          | .98669         | .01331         | 82,835         | 32.31          | 26       |
| 27       | 82,280         | 1,120          | .98639         | .01361         | 81,720         | 31.74          | 27       |
| 28       | 81,160         | 1,131          | .98607         | .01393         | 80,595         | 31.17          | 28       |
| 29       | 80,029         | 1,141          | .98574         | .01426         | 79,459         | 30.60          | 29       |
| 30       | 78,888         | 1,153          | .98539         | .01461         | 78,312         | 30.04          | 30       |
| 31       | 77,735         | 1,164          | .98503         | .01497         | 77,153         | 29.48          | 31       |
| 32       | 76,571         | 1,175          | .98465         | .01535         | 75,984         | 28.92          | 32       |
| 33       | 75,396         | 1,188          | .97425         | .01575         | 74,802         | 28.36          | 33       |

|    |        |       |        |        |        |       |
|----|--------|-------|--------|--------|--------|-------|
| 34 | 74,208 | 1,199 | ·98384 | ·01616 | 73,609 | 27·80 |
| 35 | 73,009 | 1,211 | ·98341 | ·01659 | 72,401 | 27·25 |
| 36 | 71,798 | 1,223 | ·98297 | ·01703 | 71,187 | 26·70 |
| 37 | 70,575 | 1,236 | ·98249 | ·01751 | 69,957 | 26·16 |
| 38 | 69,339 | 1,248 | ·98200 | ·01800 | 68,715 | 25·62 |
| 39 | 68,091 | 1,260 | ·98149 | ·01851 | 67,961 | 25·08 |
| 40 | 66,831 | 1,272 | ·98097 | ·01903 | 66,195 | 24·53 |
| 41 | 65,559 | 1,286 | ·98038 | ·01962 | 64,916 | 24·00 |
| 42 | 64,273 | 1,297 | ·97982 | ·02018 | 63,625 | 23·47 |
| 43 | 62,976 | 1,311 | ·97918 | ·02082 | 62,321 | 22·94 |
| 44 | 61,665 | 1,317 | ·97855 | ·02145 | 61,001 | 22·42 |
| 45 | 60,342 | 1,334 | ·97789 | ·02211 | 59,675 | 21·90 |
| 46 | 59,008 | 1,346 | ·97719 | ·02281 | 58,335 | 21·38 |
| 47 | 57,662 | 1,360 | ·97641 | ·02359 | 56,982 | 20·87 |
| 48 | 56,302 | 1,371 | ·97565 | ·02435 | 55,617 | 20·36 |
| 49 | 54,931 | 1,380 | ·97488 | ·02512 | 54,241 | 19·86 |
| 50 | 53,551 | 1,392 | ·97401 | ·02599 | 52,855 | 19·36 |
| 51 | 52,159 | 1,405 | ·97306 | ·02694 | 51,457 | 18·86 |
| 52 | 50,754 | 1,412 | ·97218 | ·02782 | 50,048 | 18·37 |
| 53 | 49,342 | 1,423 | ·97116 | ·02884 | 48,631 | 17·88 |
| 54 | 47,919 | 1,431 | ·97014 | ·02986 | 47,204 | 17·40 |
| 55 | 46,488 | 1,439 | ·96905 | ·03095 | 45,769 | 16·92 |
| 56 | 45,049 | 1,446 | ·96790 | ·03210 | 44,326 | 16·44 |
| 57 | 43,603 | 1,455 | ·96663 | ·03337 | 42,876 | 15·97 |
| 58 | 42,148 | 1,461 | ·96534 | ·03466 | 41,418 | 15·50 |
| 59 | 40,687 | 1,461 | ·96409 | ·03591 | 39,957 | 15·04 |
| 60 | 39,226 | 1,466 | ·96263 | ·03737 | 38,493 | 14·58 |
| 61 | 37,760 | 1,471 | ·96104 | ·03896 | 37,025 | 14·13 |
| 62 | 36,289 | 1,469 | ·95952 | ·04048 | 35,555 | 13·68 |
| 63 | 34,820 | 1,470 | ·95778 | ·04222 | 34,085 | 13·24 |
| 64 | 33,350 | 1,467 | ·95601 | ·04399 | 32,617 | 12·80 |
| 65 | 31,883 | 1,462 | ·95414 | ·04586 | 31,152 | 12·37 |
| 66 | 30,421 | 1,458 | ·95207 | ·04793 | 29,692 | 11·94 |

TABLE No. 19 (contd.).

## Egyptian Life-Table.

## Females (1917-1927).

| Age<br>x | I<br>x | d<br>x | P<br>x | q<br>x | L <sub>x</sub> | e <sub>x</sub> | Age<br>x |
|----------|--------|--------|--------|--------|----------------|----------------|----------|
| 67       | 28,963 | 1,453  | .94983 | .05017 | 28,237         | 11.51          | 67       |
| 68       | 27,510 | 1,442  | .94758 | .05242 | 26,789         | 11.09          | 68       |
| 69       | 26,060 | 1,428  | .94522 | .05478 | 25,354         | 10.68          | 69       |
| 70       | 24,640 | 1,416  | .94283 | .05747 | 23,932         | 10.27          | 70       |
| 71       | 24,224 | 1,401  | .93967 | .06033 | 22,524         | 9.87           | 71       |
| 72       | 23,    | 1,379  | .93681 | .06319 | 21,134         | 9.47           | 72       |
| 73       | 21,823 | 1,361  | .93343 | .06657 | 19,764         | 9.07           | 73       |
| 74       | 10,444 | 1,336  | .92999 | .07001 | 18,415         | 8.68           | 74       |
| 75       | 19,083 | 1,308  | .92630 | .07370 | 17,093         | 8.30           | 75       |
| 76       | 17,747 | 1,279  | .92220 | .07780 | 15,800         | 7.92           | 76       |
| 77       | 16,439 | 1,247  | .91774 | .08226 | 14,537         | 7.54           | 77       |
| 78       | 15,160 | 1,212  | .91289 | .08711 | 13,307         | 7.18           | 78       |
| 79       | 13,913 | 1,171  | .90780 | .09220 | 12,116         | 6.81           | 79       |
| 80       | 12,701 | 1,129  | .90208 | .09792 | 10,966         | 6.45           | 80       |
| 81       | 11,530 | 1,084  | .89578 | .10422 | 9,859          | 6.10           | 81       |
| 82       | 0,401  | 1,035  | .88891 | .11109 | 8,800          | 5.75           | 82       |
| 83       | 9,317  | 984    | .88119 | .11881 | 7,790          | 5.41           | 83       |
| 84       | 8,282  | 930    | .87257 | .12743 | 6,833          | 5.07           | 84       |
| 85       | 7,298  | 972    | .86307 | .13693 | 5,932          | 4.74           | 85       |
| 86       | 6,368  | 810    | .85262 | .14738 | 5,091          | 4.41           | 86       |
| 87       | 5,496  | 749    | .84016 | .15984 | 4,362          | 3.09           | 87       |
| 88       | 4,686  | 684    | .82626 | .17374 | 3,595          | 4.76           | 88       |
| 89       | 3,937  | 618    | .81002 | .18998 | 2,944          | 3.44           | 89       |
| 90       | 3,253  | 549    | .79165 | .20835 | 2,371          | 3.13           | 90       |

|     |       |     |        |         |       |      |     |
|-----|-------|-----|--------|---------|-------|------|-----|
| 91  | 2,086 | 481 | .76942 | .23058  | 1,846 | 2.82 | 91  |
| 92  | 1,605 | 415 | .74143 | .25857  | 1,398 | 2.51 | 92  |
| 93  | 1,190 | 346 | .70924 | .29076  | 1,017 | 2.21 | 93  |
| 94  | 844   | 282 | .66588 | .33412  | 703   | 1.91 | 94  |
| 95  | 562   | 219 | .59032 | .40968  | 453   | 1.62 | 95  |
| 96  | 343   | 159 | .53644 | .46356  | 269   | 1.34 | 96  |
| 97  | 184   | 106 | .42391 | .57609  | 131   | 1.04 | 97  |
| 98  | 78    | 58  | .05641 | .74359  | 49    | .77  | 98  |
| 99  | 20    | 19  | .05000 | .95000  | 10.5  | .55  | 99  |
| 100 | 1     | 1   | .00000 | 1.00000 | .5    | .50  | 100 |

TABLE No. 20.—SHOWING THE AGES FOR ENGLAND, INDIA AND LAGOS, FOR WHICH THE EXPECTATIONS OF LIFE ARE APPROXIMATELY EQUAL TO THE EGYPTIAN EXPECTATIONS AT THE FOLLOWING AGES.

| Age | Males |       |             | Females |       |             |
|-----|-------|-------|-------------|---------|-------|-------------|
|     | India | Lagos | England     | Age     | India | Lagos       |
| 10  | —     | 18    | 29          | 10      | —     | 28          |
| 20  | 11    | 27    | 36          | 20      | 5     | 35          |
| 30  | 20    | 35    | 42          | 30      | 16    | 42          |
| 40  | 29    | 43    | 48          | 40      | 27    | 49          |
| 50  | 40    | 50    | 55          | 50      | 38    | 56          |
| 60  | 53    | 58    | 61          | 60      | 49    | 62          |
| 70  | 61    | 67    | 68          | 70      | 60    | 69          |
| 80  | 70    | 76    | 76          | 80      | 69    | 77          |
| 90  | 80    | 88    | 89          | 90      | 80    | 69          |
| 100 | 93    | 95    | over<br>107 | 100     | 93    | over<br>107 |

Not  
Computed.

## APPENDIX

## “Notes on the Graduation of Age-Distribution”

The Census figures for the males and females of 1927 were grouped in quinquennial age-groups; while those of 1917 were grouped in decennial age-groups. The first step is to calculate the first four moments  $\nu_1, \nu_2, \nu_3$ , and  $\nu_4$ , about a working origin. These four moments of the males and females distributions of 1927, have been modified according to the abruptness corrections; while for the distributions of 1917 the moments have not been corrected to abruptness for lack of information. The corrected moments about the start can be obtained from the following formulæ:\*

$$\mu'_1 = \nu'_1 + \left\{ \frac{1}{12} \left( a'_1 - \frac{1}{60} a'_3 + \frac{1}{2520} a'_5 \right) + \frac{1}{12} \left( b'_1 - \frac{1}{60} b'_3 + \frac{1}{2520} b'_5 \right) \right\}$$

$$\mu'_2 = \nu'_2 - \frac{h^2}{12} - \frac{h^2}{120} \left( a'_2 - \frac{5}{126} a'_4 \right) + b'_5 \text{ terms}$$

$$\mu'_3 = \nu'_3 - \frac{h^3}{4} \nu'_1 - \frac{h^3}{40} \left( a'_1 - \frac{5}{63} a'_3 + \frac{1}{240} a'_5 \right) + b'_5 \text{ terms}$$

$$\mu'_4 = \nu'_4 - \frac{1}{2} \nu'_2 h^2 + \frac{7}{240} h^4 + \frac{h^4}{126} \left( a'_2 - \frac{7}{80} a'_4 \right) + b'_5 \text{ terms}$$

where  $h$  is the unit of grouping;  $a_s$  and  $b_s$  are the abruptness coefficients. In the present case, there is a very steep slope at the beginning of the curve only and a high contract at the other end of the curve, thus the  $b_s$  terms vanish from the above equations, while the values of  $a_s$  are given by the formulæ:—

$$Na_1 = - \frac{1}{60} (137 n'_1 - 163 n'_2 + 137 n'_3 - 63 n'_4 + 12 n'_5)$$

$$Na_2 = - \frac{1}{12} (45 n'_1 - 109 n'_2 + 105 n'_3 - 51 n'_4 + 10 n'_5)$$

$$Na_3 = - \frac{1}{4} (17 n'_1 - 54 n'_2 + 64 n'_3 - 34 n'_4 + 7 n'_5)$$

$$Na_4 = (3 n'_1 - 11 n'_2 + 15 n'_3 - 9 n'_4 + 2 n'_5)$$

$$Na_5 = - (n'_1 - 4 n'_2 + 6 n'_3 - 4 n'_4 + n'_5)$$

\* On Corrections for Moment Coefficients by Eleanor Fairman and Karl Pearson *Biometrika*, Vol. XII, p. 131-258.

$$\text{while } a'_s = \frac{a_s}{h} \text{ where } h = .2$$

$N$  is the size of the population ;  $n'_1, n'_2, n'_3, n'_4$  and  $n'_5$  are the five sub-groups of the first age-group, *i.e.* the number of males or females, in the first, second, third, fourth and fifth year of age respectively, as reported in the Census of 1927 plus the proportionate numbers of the individuals, whose ages are unstated in the Census Returns.

Thus, we get,  $\mu'_1, \mu'_2, \mu'_3$  &  $\mu'_4$  about the start, then the moments about the mean  $\mu^s$  can be calculated from the following equations :—

$$\mu_1 = 0$$

$$\mu_2 = \mu'_2 - \mu'^2_1 \quad ; \quad \sigma = \sqrt{\mu_2}$$

$$\mu_3 = \mu'_3 - 3\mu'_1\mu'_2 + 2\mu'^3_1$$

$$\mu_4 = \mu'_4 - 4\mu'_1\mu'_3 - 6\mu'^2_1\mu'_2 - 3\mu'^4_1$$

Consequently, the two fundamental constants  $\beta_1$  and  $\beta_2$  determining the shape of the distribution can be easily calculated from :—

$$\beta_1 = \frac{\mu_3}{\mu_2^3} \quad ; \quad \beta_2 = \frac{\mu_4}{\mu_2^4}$$

It has been found that the four points  $(\beta_1, \beta_2) s=1, 2, 3, 4$  ; representing the male and female distributions of 1927 and 1917, in the  $(\beta_1, \beta_2)$  plane, lie very close to the lower part of the biquadratic ; a criterion which indicates that the appropriate Pearsonian curve is Type IX. The curve is of the form :—

$$y = y_0 (a - x)^\lambda$$

where  $y_0$ ,  $a$  and  $\lambda$  are constants to be determined by the distribution in question.

Now, since the points  $(\beta_1, \beta_2)$  do not lie exactly on the lower part of the biquadratic, we are unable to find out the values of the constants such as to make the first four moments of the curve equal to those of the distribution ; but owing to the fact that  $\beta_2$  is subject to a large probable error, we may be justified in fitting the distribution by a curve, the three first moments of which are equal to those of the distribution, while  $\beta_2$  of the curve is not equal to that of the distribution, but equal to the value

of  $\beta_2$ , obtained from the biquadratic, corresponding to  $\beta_1$ . In this case the value of  $\lambda$  can be obtained from the following cubic:—

$$\lambda^3 (\beta_1 - 4) + \lambda^2 (9 \beta_1 - 12) + 24 \lambda \beta_1 + 16 \beta_1 = 0$$

The real root of  $\lambda$  has been obtained by means of Newton's successive approximations. The other two constants  $a$  and  $y_0$  can be calculated from the following equations:—

$$a = \frac{\sigma (2 + \lambda)}{\sqrt{(1 + \lambda) / (3 + \lambda)}} \quad ; \quad y_0 = \frac{N (1 + \lambda)}{a^{1 + \lambda}}$$

where  $\sigma$  is the standard deviation of the distribution;  $N$  is the number of the individuals composing the population.

The four curves representing the males and females distribution in 1927 and 1917, have been found by the above-mentioned method, and they assume the following equations:—

$$\text{Males } 1927: y = 2063.80 (19.984040 - x)^{2.094194} \quad (1)$$

$$\text{Females } 1927: y = 3006.62 (19.997670 - x)^{1.955479} \quad (2)$$

$$\text{Males } 1917: y = 5155.30 (11.154615 - x)^{2.467305} \quad (3)$$

$$\text{Females } 1917: y = 7760.57 (11.092007 - x)^{2.281133} \quad (4)$$

It should be noted that the unit of  $x$  is equal to 5 years in equations (1) and (2); while it is equal to 10 years in equations (3) and (4).

These four curves, together with the corresponding histograms of the populations, are represented by the four Diagrams (3), (4), (5) and (6).



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## TABLE OF CONTENTS.

### ECONOMICS AND LAW

PAGE

M. R. EL-SHANAWANY.—The First National Life Tables for Egypt 209-269

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