THE DEMOGRAPHIC POSITION OF EGYPT[1]

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WITH a population of about sixteen and a half million, Egypt may seem to be relatively unimportant in world population problems. It is true that from the standpoint of size Egypt is not one of the critical areas such as India or China. On the other hand, the population problems of Egypt epitomize in some respects those of the vast Mohammedan world and particularly for that reason are worthy of study. Although the demographic data for Egypt are far from ideal, they are much more adequate than those for some of the other countries in which similar problems exist on a much wider scale.

The political boundaries of Egypt include about 386,100 square miles (1,000,000 square kilometers), but over 95 per cent of this area is barren desert. The country has aptly been described as a vast desert pierced by the Nile. The desert and the Nile not only describe the physical characteristics but also set the pattern of population distribution. Of the 15,932,694 persons reported by the 1937 Census, over 99 per cent lived in the delta and in the narrow and sharply defined strip of fertile land bordering the Nile, although the delta and the valley contain only 13,198 square miles, or less than 4 per cent of the area within Egypt's political boundaries.

Thus, as in Biblical times, the real Egypt of today is the Egypt of the Nile. Hemmed in by the desert and virtually without rainfall, the country is vitally dependent on the yearly flood of silt-laden water. Sir William Willcocks has said, "Egypt is nothing more than the deposit left by the Nile in flood... Cut off this supply for a single season and the entire population of Egypt would be in the grip of famine; curtail it to any serious extent for a few years, and the strip of cultivation would disappear."[2]

[1] A preliminary report on a study being made under the auspices of the Office of Population Research, Princeton University, with the cooperation of the Milbank Memorial Fund.

[2] Low, Sidney: EGYPT IN TRANSITION. New York, The Macmillan Company, 1914, p. 133.

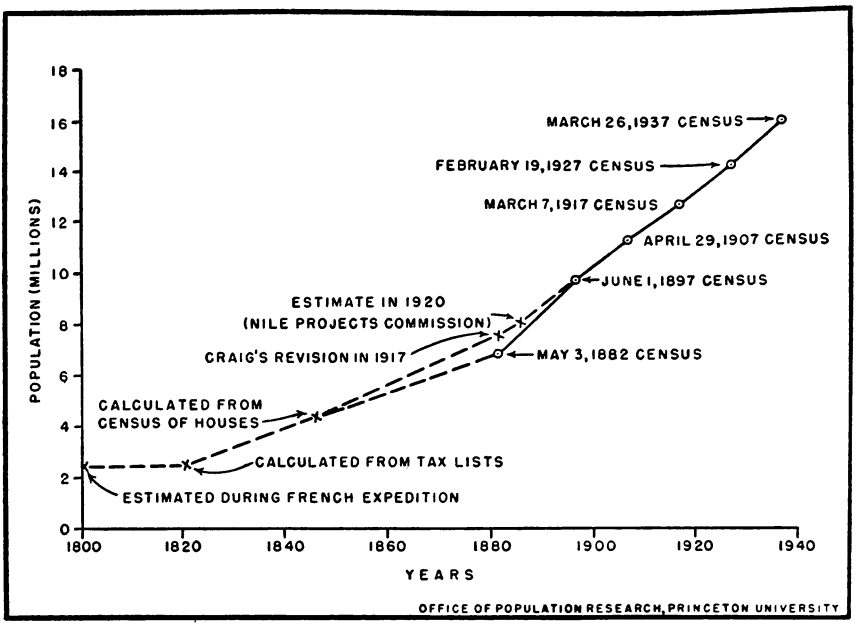

Fig. 1. Population growth in Egypt as indicated by census figures and earlier estimates.

Growth of Population. The published data concerning Egypt's population growth since 1800 are charted in Figure 1. We will not be concerned here with Egypt's population during ancient or medieval times. Suffice it to state that whereas estimates extend from three to twenty-four million, some of the modern scholars doubt the population of ancient or medieval Egypt ever exceeded seven or eight million.

There is also uncertainty concerning the size of Egypt's population during the early part of the nineteenth century when the country, after centuries of obscurity, was flung into the current of world affairs first by the short-lived conquest of Napoleon and later by the reign of the Albanian conqueror, Mohamed Ali. The estimate of two and a half million for 1800, made during the French expedition, and the slightly higher estimate for 1821, made on the basis of tax lists, may seem somewhat low in view of the considerably higher estimates for ancient and medieval times. They

may also seem low in relation to the estimate of 4.5 million for 1846, calculated from a census of houses. On the other hand, there is hardly any doubt that the population of Egypt had been larger than it was at the beginning of the nineteenth century. In explanation, Cleland has stated that "some centuries of misrule, exploitation, and civil strife under the Mameluke chieftains had greatly decimated the population and wasted the country's wealth."[3] Other writers have stated that under the Mamelukes large areas of previously cultivated land were allowed to revert to desert and salt marsh. Students of the problem have generally agreed that a new cycle of population growth in Egypt began during the reign of Mohamed Ali (1805-1848). They mention the irrigation works, improved sanitation, and stabilization of government as well as considerable immigration during the early years. Nevertheless, it is quite possible that the early estimates of population were too low and that the growth from 1821 to 1846 was not so great as that indicated by the population estimates for those years.

Whatever that situation may have been, there is no doubt about the rapid increase of population in more recent times. The population has more than doubled since 1882, the year of the first census of Egypt in modern times.[4] This has meant a serious increase in population density owing to the relatively inelastic amount of cultivable land available.[5] In 1882, there were 562 persons per square mile (217 per square kilometer); in 1937 there were 1,198 (463 per square kilometer).[6]

[3] Cleland, Wendell: THE POPULATION PROBLEM IN EGYPT. Lancaster, Pennsylvania, The Science Press Printing Company, 1936, p. 6.

[4] This statement holds true even on the basis of the upward revision of the population for 1882. Approximately 6.8 million persons were counted in the 1882 Census. In 1917, J. I. Craig, former Controller of the Egyptian Statistical Department, estimated that the population of 1882 was probably about 7.55 million, or about 11 per cent above the number enumerated. In line with this estimate is one concerning the1886 population, made in 1920 by the Nile Projects Commission. *See* Figure 1.

[5] According to the Nile Projects Commission, whereas the population of Egypt increased 76 per cent during 1886-1927, the total cultivable area increased 11 per cent, and the crop area increased 30 per cent. *See* Cleland, *op. cit.*, p. 34.

[6] In line with Egyptian Census practice, the figures on density relate to Egypt exclusive

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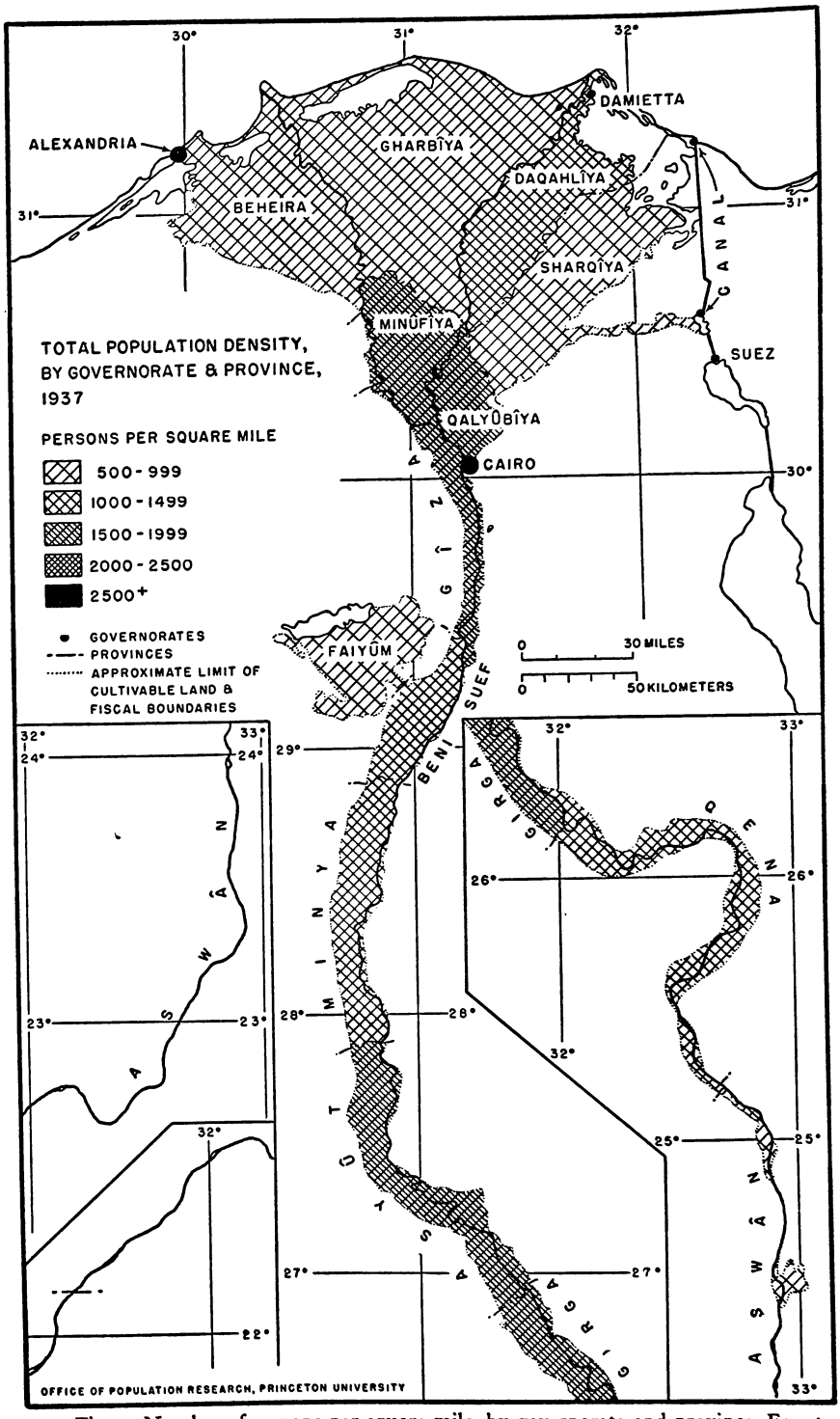

Fig. 2. Number of persons per square mile, by governorate and province. Egypt exclusive of frontier districts, 1937.

The densities by governorate and province are shown in Figure 2. The number of persons per square mile in each of the five governorates is indicated in the chart simply as 2,500 and over. This category conceals wide differences, since the density ranges from 2,751 in Suez to 45,416 in Damietta. (The latter, however, had an area of only nine-tenths of a square mile in 1937 and a population of 40,332.) For two important governorates, Cairo and Alexandria, the persons per square mile were 20,609 and 24,364, respectively. The governorates, being mainly urban,[7] are more densely populated than the provinces. However, although each of the fourteen provinces is predominantly rural, five of them contained 500-999 persons per square mile, four were in the 1,000-1,499 range, and five were over 1,500. Two of these, Minûfîya and Girga, had about 1,885 persons per square mile in 1937. Also relatively high were Qalyûbîya and Gîza, just north and south of Cairo, respectively. The relatively low average densities of the three large provinces in the delta (Beheira, Gharbîya, and Sharqîya) are doubtless due in large measure to the extensive areas of salt marsh and other unreclaimed land within the fiscal boundaries of those provinces.

With an average of about 1,200 persons per square mile, occupied Egypt is one of the most densely settled countries in the world. Furthermore, Egypt is preeminently an agricultural country, and yet the density of its occupied area is higher than that of heavily industrialized England, and higher than that of Belgium, the most thickly settled country of continental Europe.

Even on the basis of persons dependent on agriculture per square

of frontier districts. More specifically, the area and population considered are those of the combined governorates and provinces, or essentially those of the delta and valley (*see* Figure 2). The computed density for 1882 (217 per square kilometer) was based upon Craig's upward revision of the population reduced by an estimated number of inhabitants of frontier districts. The 1937 Census, using the enumerated population of 1882, gives a population density of only 195 per square kilometer for the earlier year.

[7] The five governorates are separate political and territorial entities. All are specific cities except Canal, which embraces two cities, Port Said and Ismalia, together with a relatively small amount of rural population. This separate treatment of governorates is forced by nature of the data and does not result in a clear-cut rural-urban differentiation of the population. There remain the provincial capitals as well as other towns within the provinces.

mile of agricultural land, the average figures are 1,094 for total Egypt, 970 for Lower Egypt (the delta), and 1,270 for Upper Egypt (the valley).[8] The lower average density in the delta than in the valley quite possibly is due in some measure to the greater prevalence of waste land in that area despite the attempt at restriction to agricultural land. At all events, to find problems of density of population that are on a par with those of Egypt, one must go to areas such as Java, China, and the Ganges Valley.

Nativity and Religion. The rapid growth and increasing density occurs in an extraordinarily homogeneous population. In the 1937 Census, 99 per cent of the inhabitants of Egypt were recorded as native. In fact, 92 per cent were born in the province or governorate of residence.

By religion, 91.4 per cent of the population were Mohammedans in 1937, 8.2 per cent were Christians, and 0.4 per cent were Jewish. The Christians were mainly "Copts," adherents of the old Coptic Church of Egypt. The "Copts" comprised 6.9 per cent of the total population, Catholics comprised 0.8 per cent, and Protestants 0.5 per cent.

The Mohammedans predominate in all areas of Egypt. In no governorate or province did they comprise less than three-fourths of the population in 1937. The lowest proportionate importance was found in Alexandria where it was 77 per cent. The proportion was 81 per cent in Cairo. Even in the so-called Coptic capital of Egypt, the province of Asyût in Upper Egypt, Mohammedans comprised 78 per cent of the population.

Rurality. The population is mainly rural. It should be stated at the outset, however, that the rural-urban dichotomy is not so clear-

[8] The above figures on density of the agricultural population are to be regarded as only approximate. The acreage of agricultural land in 1929 was obtained for Lower and Upper Egypt from International Institute of Agriculture: THE FIRST WORLD AGRICULTURAL CENSUS (1930), Rome, 1939, Vol. V, p. 177. From 1937 Census data it was possible to secure the per cent of occupied males in agriculture. These figures were converted to per cent of total population dependent on agriculture by application of a regression equation based upon direct data for these two variables obtained from 1927 Census data for selected provinces in Turkey.

cut and meaningful in Egypt as in our own country. There is little in the way of open spaces and isolated farm homes in the habitable land of Egypt. Even the agricultural families live compactly. On the other hand, of course, there are definitely cities and urban communities. According to computations from the 1939 VITAL STATISTICS, only about 27 per cent of the people of Egypt resided in towns of 10,000 and over;[9] about 73 per cent were in rural or village areas. By province, wherein the governorates are excluded, rural or village population extended from 79 to 90 per cent.

For indications of trends in urbanization, we must resort to census figures concerning proportions of persons in rather large cities, the governorates and provincial capitals. These figures indicate that, although there has been no striking increase in the proportion living in these cities since 1897, the increase was somewhat greater for the governorates (populations dominated by Cairo and Alexandria) than for the smaller provincial capitals. The governorates contained 10.3 per cent of Egypt's population in 1897 and 14.1 per cent in 1937. The provincial capitals contained 4.0 per cent in 1897 and 4.4 per cent in 1937.

Illiteracy. Illiteracy is a common characteristic. In 1937, about 85 per cent of the population 10 years of age and over were unable to read and write. The lowest percentages were found for Cairo and Alexandria, but even in these cities, they were 60 and 62, respectively. In the provinces and frontier districts, the percentages illiterate extended from 79 to 93. By sex, the percentages illiterate were 77 for males and 94 for females.

Even among the literate population, very few have the equivalent

[9] Although included with "towns" for the above computations, some of the localities of 10,000-24,999 were in fact villages in the administrative sense in that they were governed by village councils as distinguished from municipal, mixed, and local commissions. On the basis of number of inhabitants of places definitely designated as "urban towns" in the 1939 VITAL STATISTICS, only about 24 per cent of Egypt's population was "urban" in that year. (*See* Egyptian Government, Ministry of Finance, Statistical Department: VITAL STATISTICS, 1939. Cairo, Government Press, 1941. Table III, pp. 30-59.) Some students regard as essentially urban only the governorates and provincial capitals, which collectively contained only 18.5 per cent of Egypt's population in 1937.

of a high school education. According to computations made from the 1937 Census, less than 1 per cent of the total population 20 years of age and over held the equivalent of a high school diploma.

School attendance, however, has increased greatly in recent years. In 1927 there were only about sixteen pupils attending school for each one hundred children 5-14 years of age. By 1937, this ratio had doubled. The greatest proportionate increases were in the most illiterate provinces and among girl students of elementary schools. Male students of elementary schools increased by about 38 per cent over the decade but the number of female students more than trebled. In 1927-1928, about one-fifth of the elementary students were girls but in 1936-1937 over one-third were girls.

Livelihood. Being largely rural, Egypt is preeminently agricultural. In 1937, 68 per cent of the occupied males were directly engaged in agriculture and the computed proportion of the total population directly dependent on agriculture was 63 per cent. There was virtually no change in the proportion dependent on agriculture over the 1927-1937 decade.

The outstanding cash crop is cotton, which normally accounts for 80-90 per cent of the value of exports and, the production of which usually occupies about one-third of the cultivated area and slightly over one-fifth of the crop area. Other important crops are maize, millet, wheat, and clover.

With respect to land ownership, Egypt can be described as a place where the majority of the agricultural families own a bit of land but most of the land is owned by a small minority. Of 2.5 million proprietors of land listed in 1938, approximately 70 per cent owned less than one feddan each (1.03 acres) and they collectively owned only 12 per cent of the cultivated land. Proprietors of one to five feddans comprised an additional 23 per cent of the owners and they owned 20 per cent of the land. In other words, 93 per cent of the owners owned less than five feddans each and they

collectively owned only 32 per cent of the land. The remaining 7 per cent of the owners owned 68 per cent of the land. Proprietors of fifty feddans (51.9 acres) and over comprised only one-half of 1 per cent of the owners, but they owned about 38 per cent of the cultivated land.[10]

According to Cleland, the 7 per cent of the landholders who own over two-thirds of the land are for the most part "the rich, the educated, the big land corporations and the officials, in other words, all the influential persons who manage the affairs of the nation. As a very large number of these owners simply let their lands at fixed rentals and spend their days in the cities, they pay little attention to the methods of the fellaheen and take no interest in anything except to collect the rents."[11]

As expected from the small size of the holdings, the bulk of the peasants live at virtually subsistence levels. The families owning less than one acre generally rent a little more land, but owing to high rents, inefficient methods of work, poor state of the public health, and sheer lack of land available, the average family of five rarely undertakes to cultivate more than two or three acres, and, according to Cleland, this means a gross family income of about $250 per year. Owners or renters of smaller parcels get along on less. The income may be supplemented somewhat by part-time employment on a cotton plantation or in a town or village but at best the situation adds up to poverty.

Vital Statistics. The rapid increase of Egypt's population has been due almost altogether to natural increase, for immigration in modern times has been negligible. The vital statistics document an enormous human wastage in this increase, for death rates are still appallingly high by Western standards.

In view of the illiterate state of the population and other factors it is not surprising that the registration of births and deaths is far

[10] Egyptian Government, Ministry of Finance, Statistical Department: ANNUAIRE STATISTIQUE, 1938-1939. Cairo, Government Press, 1940. pp. 322-323.

[11] Cleland, *op. cit.*, p. 95.

from ideal in Egypt.[12] In some localities the registration is in the hands of barbers and tax collectors. Fortunately, however, some basis for estimating the extent of non-reporting of births and deaths is afforded by the vital rates given separately for chief cities (governorates and provincial capitals) and for Health Bureau areas which include not only the chief cities but also increasing numbers of rural villages. In 1939, the Health Bureau areas included almost one-third of the total population of Egypt.

Even the recorded rates for total Egypt, including all of the poorly registered areas, give the essential story of very high levels of fertility, mortality, and infant mortality. In 1939, the recorded rates for total Egypt were 42.2 births and 26.0 deaths per 1,000 population; and 161 infant deaths per 1,000 live births. The rates based on the more adequate registration in Health Bureau areas were: birth rate, 46.8; death rate, 29.7; and infant mortality rate, 198.[13]

The following are average rates for Health Bureau populations:

Area	Birth	Death	Infant Mortality
Governorates	43.9	25.2	191
Provinces, Lower Egypt	48.6	32.0	184
Provinces, Upper Egypt	49.7	35.1	224

[12] A few words may also be said regarding the accuracy of the census. As already stated, the first attempt at a modern census was made in 1882 and the total number enumerated in that census should have been about 11 per cent higher, according to a later estimate by a Census official. Later censuses have been much more accurate but undoubtedly the census still fails to enumerate all the people for there is unmistakable evidence of substantial under-enumeration of children. The under-enumeration of children under 5 in the 1937 Census may have been as high as 25 per cent.

Probably the worst deficiency of the census, however, arises from ignorance of the people concerning their ages. Single-year age distributions of the 1927 Census data reveal very high concentrations on ages divisible by five.

To generalize the situation, the taking of the Egyptian census is organized to yield a virtually complete enumeration of households but it falls down with respect to coverage of children and with respect to accuracy of age. Civil servants are drafted for the task of enumeration and this has the advantage of permanence of organization with lines of authority and personnel extending down to the smallest village and territorial division. The deficiencies of the census can be understood when it is realized that all but a small proportion of the people are illiterate and have only the roughest notion of their ages. Also, as a result of the cloistered position of Moslem women, census enumerators generally secure their information for the total household from the male head.

[13] By governorate and province, the birth rates for Health Bureau areas extended from

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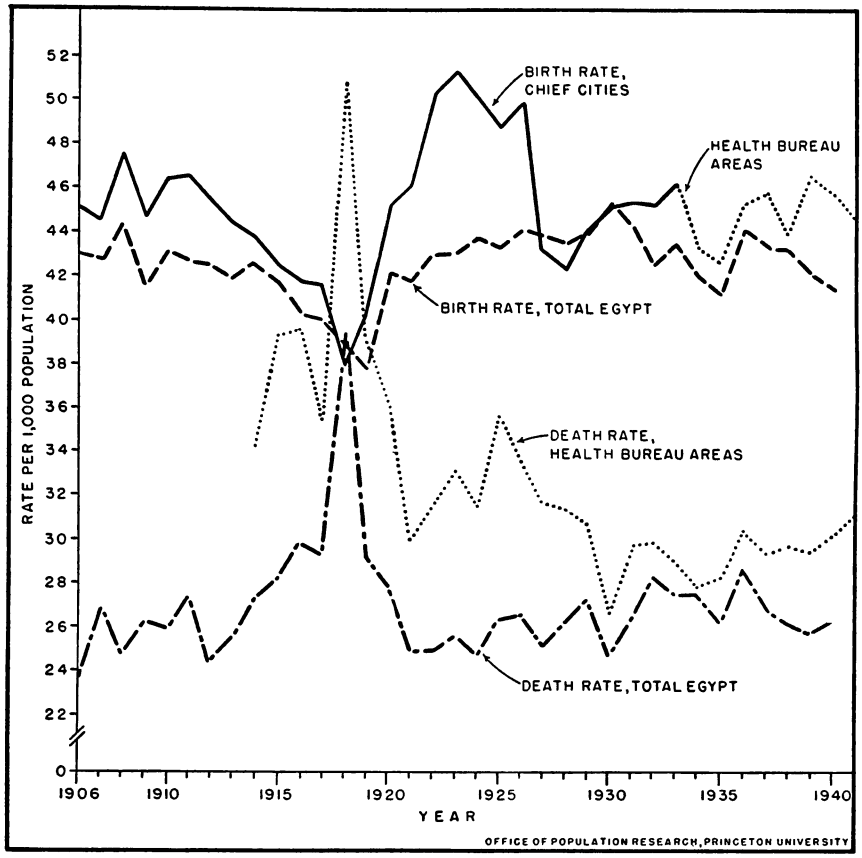

Fig. 3. Birth and death rates reported for total Egypt 1906-1940 and rates available separately for the better-registered chief cities and Health Bureau areas.

The comparison of the data for total Egypt with those for the Health Bureau areas suggests that the birth rates for the former for 1939 should be about 11 per cent higher, the death rates about 14 per cent higher, and the infant mortality rates about 23 per cent higher. The Health Bureau areas themselves are very probably not models of complete registration and their constituencies may not be representative of the total population. It is therefore necessary to emphasize that all vital rates presented in this report, regardless of

38.5 in Aswân to 54.1 in Suez. The former was the only rate under 40 and there were five provinces with rates of 50 or more. The death rates extended from 22.5 in Damietta to 43.4 in Faiyûm. The high rate for Faiyûm was approached by two other provinces. Infant mortality rates extended from 149 in Damietta to 273 in Faiyûm.

whether they are actual or derived data, must be regarded at best as approximations.

It is difficult to draw conclusions regarding trends in fertility and mortality rates during the past 35 or 40 years. Figure 3 depicts these rates for total Egypt since 1906. It also shows available data for the chief cities and Health Bureau areas. The fluctuations of both birth and death rates, seen even in the data for the presumably better registered areas, are conspicuous in this chart, for the vertical scale is broken to start at a rate of 22.

Over the long span of years since 1906, however, the data at their face value afford little indication of decline in the birth rate. At least some improvement in registration has doubtless taken place, however, and this factor might easily conceal an actual decrease. Fertility ratios computed from census data since 1907 do show a decline. According to those data the decline was largest during the first decade and was due to changes in proportions married as well as to declines in marital fertility. The number of children under 5 per 1,000 women 15-49 years of age declined 15 per cent from 1907 to 1917, remained the same until 1927, and declined 5 per cent from 1927 to 1937. The marital fertility ratio, children under 5 per 1,000 married women 15-49, declined 10 per cent from 1907 to 1917, remained virtually the same to 1927, and declined 4 per cent from 1927 to 1937. It should be stated, however, that there is some evidence that the enumeration of children under 5 years of age was less thorough in 1937 than in 1927; so the indicated decrease during that decade may be at least partially spurious.

Census Year	Children Under 5 Per 1,000 Women 15-49	
	All Women	Married Women
1907	681	859
1917	580	772
1927	578	781
1937	547	750

With regard to death rates it is practically certain that a substantial drop has occurred at least since the early part of the last century, when the population was almost at a standstill. Carr-Saunders attributes some of the early phenomenal growth to immigration but he and others presume much higher death rates in Egypt during the first half of the nineteenth century than at present and this is in line with the virtual eradication of such diseases as plague and cholera.

As to the trend of the recorded mortality rates for total Egypt since 1906 and for Health Bureau areas since 1914, shown in Figure 3, several points may be noted. The high peak in 1918, of course, is due to the influenza pandemic. The recorded data for total Egypt show no improvement in mortality conditions since 1906 but improvements in registration doubtless weigh heavily in this series of data. The Health Bureau series indicate substantially lower levels of mortality for years after 1920 than for the several years preceding the influenza epidemic. They also suggest an upward secular trend during 1930-1941. It is possible that spurious factors are involved in the apparent increase during this period. Whatever this situation may have been, there are reports of serious increases in mortality since 1941 owing to malaria and typhus. Official data on these recent developments are not yet available.

Infant mortality rates are shown in Figure 4 for total Egypt during 1919-1940 and for Health Bureau areas during 1906-1941. The rates for Health Bureau areas show a very marked decline during the period under consideration. In the early part of the period the rates were well above 300; since 1930 they have been around 200. The general decline was steepest during the period 1906-1921, rather slight from 1921 to 1930, and practically nonexistent since 1930, although in 1939 the recorded rate for Health Bureau areas fell below 200 for the first time.

For a country like Egypt it is important to learn the nature and extent of existing variations in fertility and mortality, so that there may be some basis for judging the prospect for declines in these

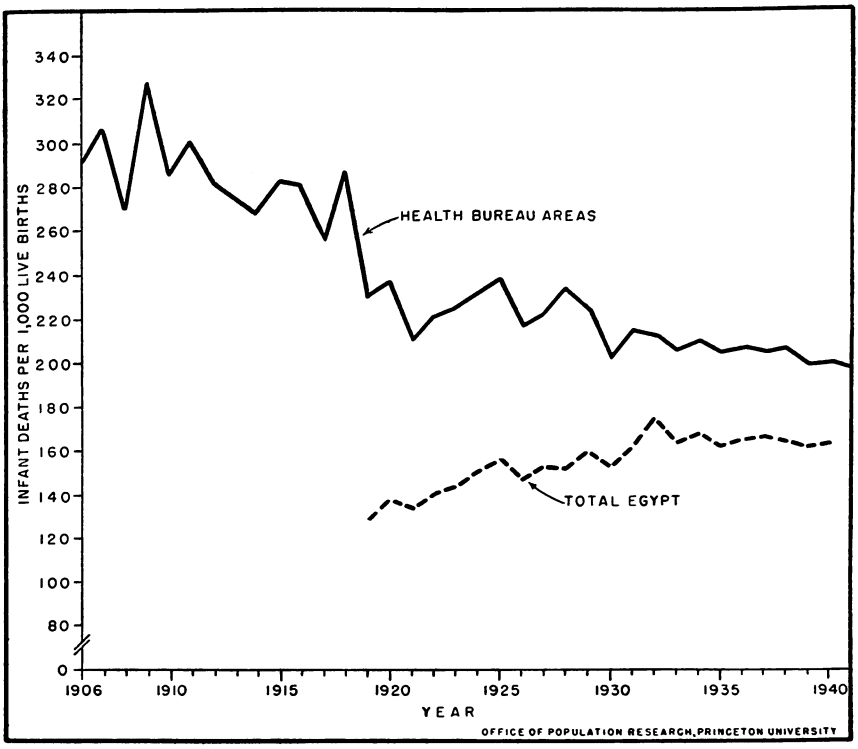

Fig. 4. Infant mortality rates reported for total Egypt 1919-1940 and for the better registered Health Bureau areas 1906-1941.

rates. Unfortunately, the data permit exploration along only a few channels such as those by type of community, area, and religion.

In Figure 5, the birth, death, and infant mortality rates are shown by size of community for total Egypt and for Lower Egypt and Upper Egypt separately. The vital rates are those of 1939 for populations in Health Bureau areas.[14] This restriction to Health Bureau areas is believed to remove most, but not all, of the differences in adequacy of registration. The "Total Urban" categories include all Health Bureau towns and cities of 10,000 and over. The "Rural and Village" classes comprise the remaining Health Bureau areas. In Upper Egypt the rates for the "Total Urban" areas are higher than the rural rates but this the writer believes to arise from better regis-

[14] The data used in computing the rates were derived from Egyptian Government, Ministry of Finance, Statistical Department: VITAL STATISTICS, 1939. Cairo, Government Press, 1941, Table III, pp. 30-59.

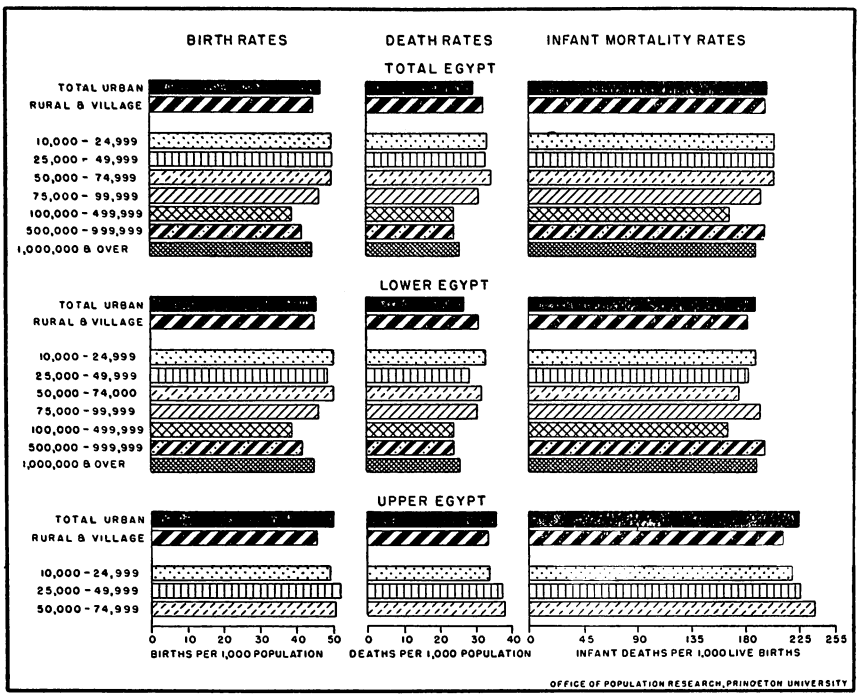

Fig. 5. Birth, death, and infant mortality rates in Health Bureau areas of Egypt, by region and type of community, 1939.

tration. In Lower Egypt the average urban rates are pulled down by virtue of the influence of large cities.[15] To generalize the situation, there appears to be no substantial rural-urban differential in fertility and mortality except in so far as the largest cities are concerned. More will be said below about the large cities but attention is called here to the appearance of somewhat higher death and infant mortality rates in Upper Egypt than in Lower Egypt when size of city is held constant. There is not much difference between those two regional divisions with respect to birth rates in cities of comparable size.

The fertility differentials by religion are wide, especially in the largest cities. In total Egypt (not restricted to Health Bureau areas) the birth rate in 1939 was 43 for Moslems, 34 for Christians, and 21

[15] Only one city is represented in each of the three categories for cities of 100,000 and over. The three listed in the order of increasing size are Port Said, Alexandria, and Cairo.

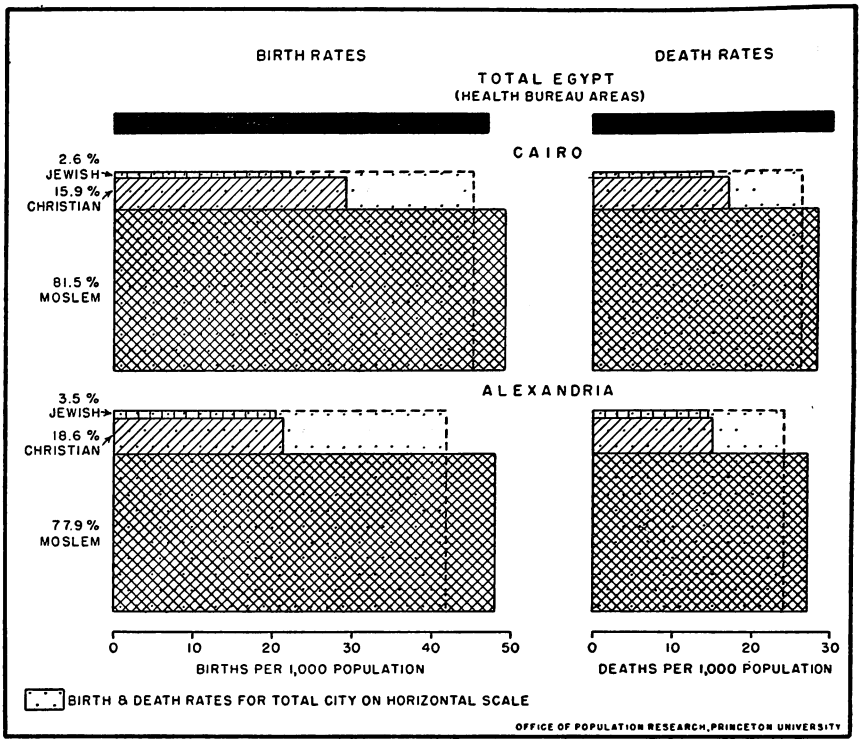

Fig. 6. Birth and death rates for Jews, Christians, and Mohammedans in Cairo and Alexandria in 1939, shown in relation to proportionate importance of these groups and in comparison with rates for Total Egypt (Health Bureau areas).

for Jews. In bringing the metropolitan and religious influences together, as in Figure 6, we find the interesting suggestion that the relatively low birth rates of the two largest cities are due in considerable measure to the influence of the non-Moslem elements in those cities. In this chart, as a basis for comparison, the birth and death rates of Health Bureau populations in total Egypt are shown by the solid black bar. Lower than these are the rates for the populations of Cairo and Alexandria, both of which are Health Bureau areas. The vertical axis for each of these two cities simply indicates the proportionate importance of the three religious groups. For instance, in Cairo the Moslems comprised about 81 per cent of the population, the Christians 16 per cent, and the Jews 3 per cent. A virtually similar composition by religion is found in Alexandria. The chief

point of interest is that the minority of non-Moslems seems to be responsible for the lower birth rates in these two cities than in total Egypt. In Cairo the birth rates were 49 for Moslems, 29 for Christians, and 22 for Jews. In Alexandria the birth differentials were essentially of this same pattern.

There is a slightly different picture with respect to death rates, for in both cities the Moslems exhibited somewhat lower rates than the average rate for all Health Bureau areas in Egypt. The death rates in Cairo were 28 for Moslems, 17 for Christians, and 15 for Jews. A rigorous analysis of the religious and metropolitan influences would demand control of age and other factors but on the basis of present materials there is the suggestion that the fertility patterns of Moslems in Egypt have not yet been much affected by urban ways even in the largest cities.

Life Tables for Egypt (1927-1937). The heavy toll of mortality in Egypt may be described in terms of life-table functions computed for the period 1927-1937 by the "census differencing" method. This was used because reliable age-specific mortality rates are not available from registration data.

The underlying theory of the "census differencing" method is simple. If a country has neither gains nor losses through migration, and if the age data are accurate, persons reported as, say, 20 years of age in 1937 may be regarded as the survivors of those reported as 10 years of age in 1927. Hence, for any given age in 1927 the probability of living or dying during ten years can be readily computed.

The first requisite for the application of this method, that of virtual absence of immigration or emigration, is easily met in so far as Egypt is concerned. The second requirement, accurate age data, is far from fulfilled by the census materials. The first task, therefore, was that of smoothing the age distributions. This was done by fitting Pearson's Type IX Curve[16] to the data. This device was

[16] The slope of Pearson's Type IX is described by the formula $y = y_0 (a-x)^m$.
Note that the y values derived by this formula are the ordinates computed for specific

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formerly used by El-Shanawany[17] in his construction of life tables for Egypt for the 1917-1927 decade by the census differencing method. One departure from El-Shanawany's procedure, however, was that of making certain preliminary adjustments of the census data before fitting the smoothed curves. Some correction for under-enumeration of children under 5 was made and a little was done in the way of arbitrary but systematic redistribution of population in other age groups in order to reduce some of the more prominent irregularities.[18] The extent of all preliminary adjustments of the 1937 Census is illustrated in Figure 7.

The first step in the life-table construction, that of computing the probabilities of dying within ten years, was done by staggering the ordinate values of the smoothed curve for 1927 ten years in age behind the 1937 ordinates, deriving the differences at selected ages and dividing by the 1927 ordinate values. It was necessary, however, to reconstruct the ${}_nq_x$ values for ages under 10, for the originally computed probabilities of death at these ages were inordinately

ages for use in the census differencing method. An integral form of the equation was used for computing the populations within five-year age groups, plotted in Figure 7.

[17] El-Shanawany, M. R.: The First National Life Tables for Egypt. *L'Egypte Contemporaine,* March, 1936, No. 162, pp. 209-269.

[18] This consisted chiefly in systematically consigning given proportions of persons reporting ages divisible by five to the preceding five-year age group. Single-year age distributions of the 1927 Census population provided by El-Shanawany indicated marked concentrations on ages that were multiples of five. This type of concentration was stronger on even than on odd multiples of five, so some of the serrations persisted in the five-year groupings. Toward the end of partial correction for this the following operations were carried through for the males and females for 1927 and 1937. (Single-year age distributions were not available for 1937, but they were estimated by applying the percentage distribution by single year of age within each five-year age group in 1927.)

0- 4	No change except adjustment for under-enumeration
5- 9	Census figure plus one-fourth of age 10
10-14	Census figure less one-fourth of age 10 plus one-half of age 15
15-19	Census figure less one-half of age 15 plus one-half of age 20
20-24	Census figure less one-half of age 20 plus one-half of age 25, etc.

The above adjustments were sufficient to remove the serrations in the census data above age 50, but a few additional redistributions were included in the preliminary adjustments of younger ages. These were made in order to reduce the trough and cusp characteristics within the 15-40 age range. This step seemed desirable since examination of census distributions for preceding dates attested to the unreality of these characteristics and it was thought that partial correction preliminary to smoothing would yield truer slopes of the smoothed age curves. The adjustment of this type for males was a little different from that for females but for each sex group the adjustment for the two census years was the same.

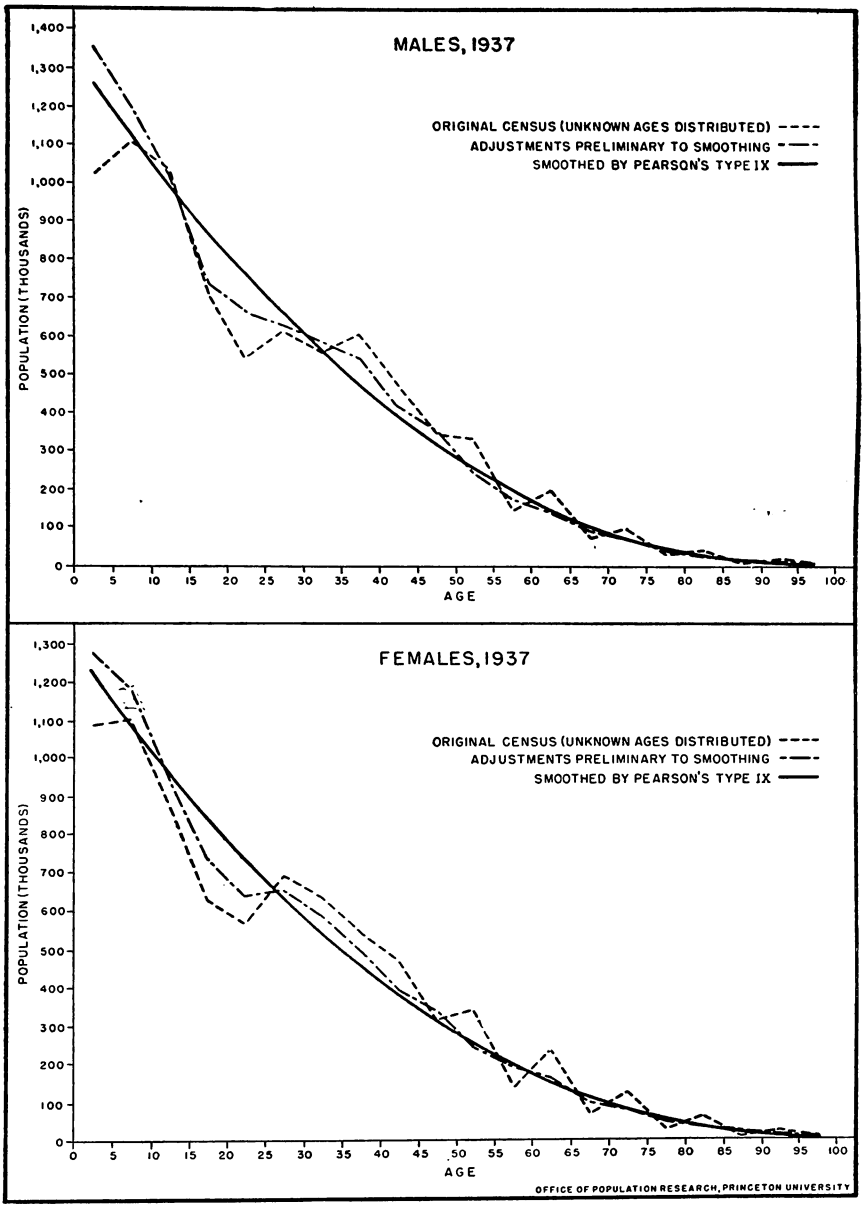

Fig. 7. Five-year age distributions as reported in the 1937 Census of Egypt, as adjusted preliminary to smoothing, and as smoothed according to Pearson's Type IX.

low.[19] As a basis for reconstruction, the infant mortality rates for

[19]El-Shanawany also encountered unsatisfactory results for ages under 10. His recourse was that of placing the radix of his 1917-1927 life tables at age 10.

(Continued on page 402)

Age	Number of Survivors (l_x)		Complete Expectation of Life in Years (e°_x)	
	Males	Females	Males	Females
0	100,000	100,000	30.2	31.5
1	77,710	79,950	37.7	38.3
5	64,061	67,775	41.5	41.0
10	61,390	65,613	38.2	37.2
20	52,980	55,961	33.5	32.8
30	44,916	46,660	28.6	28.3
40	36,970	37,673	23.7	23.9
50	28,973	29,016	18.8	19.6
60	20,887	20,793	14.2	15.4
70	12,931	13,239	9.9	11.4
80	5,836	6,797	6.2	7.6
90	1,083	2,157	4.3	4.3
100	12	22	—	—

Table 1. Life table survivorship (l) and expectation of life ($e^\circ x$) at given ages in Egypt, 1927-1937.

Health Bureau areas were expressed in terms of unity for the ${}_1q_0$ values (probability of dying within the first year of age), and the ${}_4q_1$ and ${}_5q_5$ values were computed on the basis of adjusted vital statistics data. Needless to say, no claim is made that the life-table functions computed for Egypt are more than reasonable approximations.

On the basis of our 1927-1937 life table for Egypt, the females have a slight advantage over males in survivorship (Table 1). Among males, only 78 per cent reach one year of age, 64 per cent reach five, 53 per cent reach twenty years of age, and 21 per cent reach sixty. The data for females suggest that about 80 per cent reach their first year of age, 68 per cent reach five, 56 per cent reach twenty, and 21 per cent reach sixty.

The survivorship (l_x) data for males are shown in Figure 8 for Egypt and several other countries. Those for India are from life tables constructed by Dr. Kingsley Davis by age-smoothing and

The fundamental difficulty was that the observed differences between y values for age 0 in 1927 and age 10 in 1937 were too small. This was apparently partly a result of the deficiencies of the original distribution at later ages. Probably as a compensation for gashes in the original curves at certain later ages the smoothed curve tended to fall below the numbers presumed (preliminary adjustments) at ages under 5.

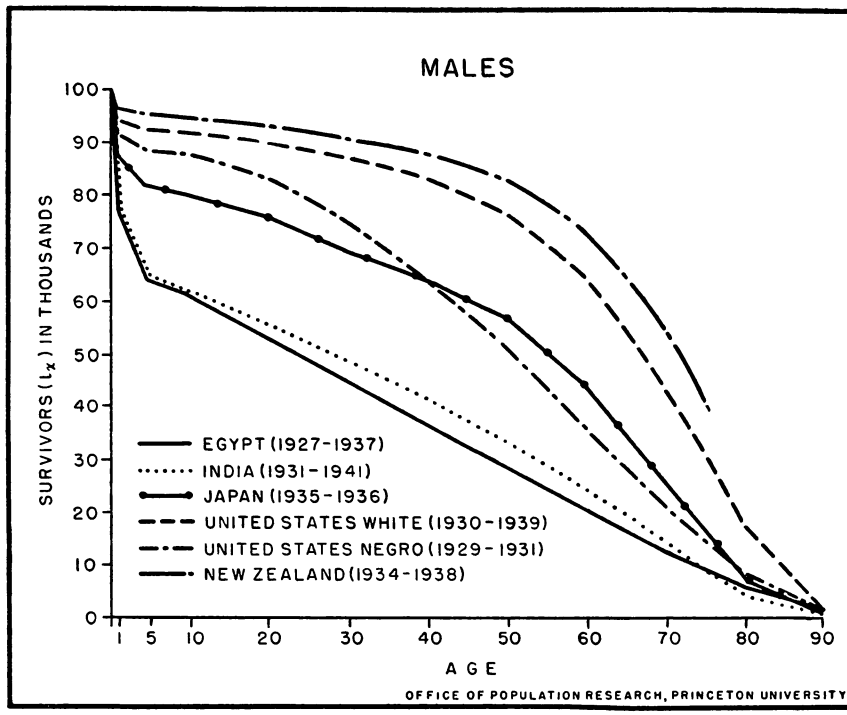

Fig. 8. Survivorship of males (l_x) in Egypt and other countries according to life tables of given dates.

census-differencing methods similar to those described for Egypt. Those for other countries are based upon published official data. One of the most striking summary comparisons by country is that of the age by which one-fourth of the original cohort are dead. Thus, one-fourth are dead at 1.8 years of age in Egypt, 2.0 years in India, 51.5 years in the United States (whites) and 58.4 years in New Zealand. In view of the nature of the data, of course, close comparisons of certain countries are not warranted. For instance, similarities of, rather than differences between, the results for Egypt and India should be emphasized. No close examination of the data is needed, however, to document the relatively low status of both Egypt and India with respect to survivorship at all ages under fifty.

The same story, of course, is told by the data on expectation of life at birth and at later ages. Figure 9 affords comparisons for males.

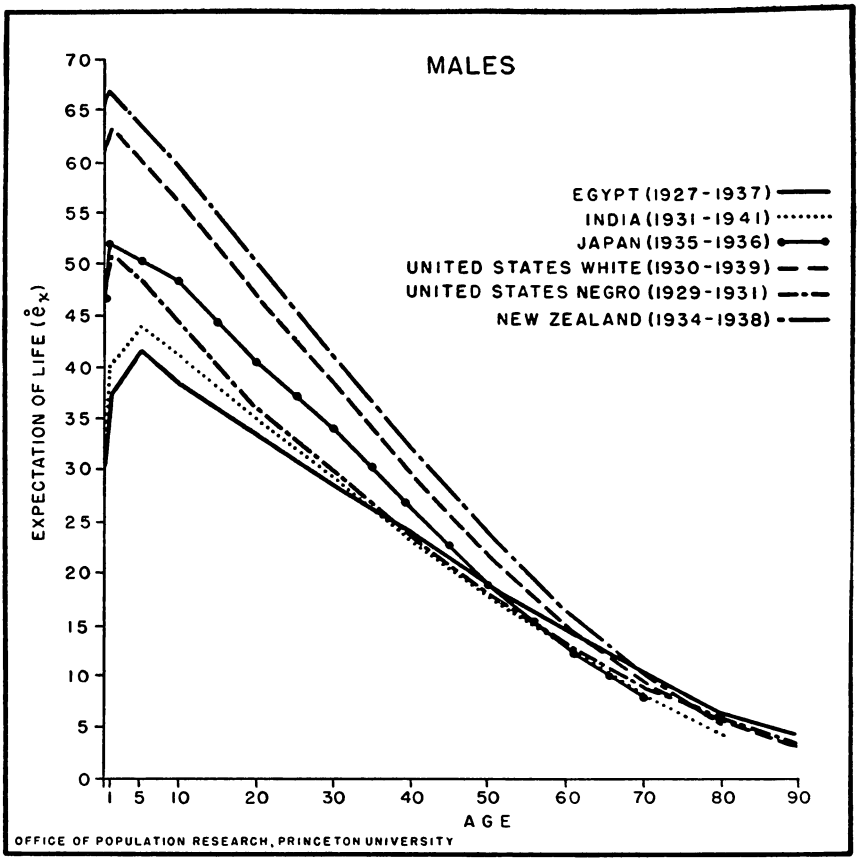

Fig. 9. Expectation of life ($\mathring{e}_x$) among males in Egypt and other countries according to life tables of given dates.

The expectation of life at birth is 30.2 in Egypt, 32.1 in India, 60.6 in the United States (whites), and 65.5 in New Zealand. Among females, the expectations of life at birth are 31.5 for Egypt, 31.4 for India, 64.6 for the United States (whites), and 68.5 for New Zealand.

There were too many departures of our procedures from those of El-Shanawany to warrant close comparison of the 1927-1937 data with those of 1917-1927. El-Shanawany began his life tables with age 10 instead of 0.[20] For males at age 10 the life expectancy is about

[20] In his discussion, however, El-Shanawany estimated that during 1917-1927 the expec-

(Continued on page 405)

38 years in both sets of material. At later ages the 1927-1937 expectancies remain about one year below the 1917-1927 figures. For females the expectancy at age 10 is lower by about four years in the 1927-1937 than in the 1917-1927 data (37.2 and 41.6, respectively). This type of difference persists in diminishing magnitude to about age 46. At later ages the difference is reversed and the 1917-1927 expectancies are about one year below those of 1927-1937. To generalize, the comparisons fail to indicate that life expectancy was higher in 1927-1937 than in the preceding decade.

Gross and Net Reproduction Rates. The high level of the gross and net reproduction rates and the gap between the two emphasize at once the high level of fertility and the appalling force of mortality in Egypt.[21] According to our computations for total Egypt the gross reproduction rate for the year 1937 was 3.11 and the net rate was 1.44. This is an unusual gap between the gross and net rates, but despite the heavy inroads of mortality, continuation of the age-specific fertility and mortality rates of 1937 would ultimately result in an increase of about 44 per cent per generation.

Little in the way of a regional pattern was revealed in the data by province.[22] The two largest cities, Cairo and Alexandria, were substantially below the average for total Egypt with respect to the gross

tation of life at birth in Egypt was approximately 31 years for males and 36 for females. The estimate for males was thus about one year higher, and that for females about four years higher, than the expectancies computed for 1927-1937.

[21] It will be recalled that the *gross reproduction rate* indicates the average number of daughters that would be borne per woman among a cohort of females starting life together *and surviving the childbearing ages,* if given levels of age-specific fertility should continue. The *net reproduction rate* involves allowance for age-specific mortality and states the average number of daughters that would be borne per female in the original cohort under given schedules of age-specific fertility *and* mortality.

A conventional indirect method was used for computing gross and net reproduction rates for Egypt and its provinces for the years 1932 and 1937, since age-specific fertility rates for Egypt were not available. The age-specific rates for Bulgaria during 1921-1922 were used in the indirect method, since these were found to require only a slight correction factor when applied to Egypt. The Egyptian life table for 1927-1937 was used for conversion from gross to net rates. The reported births for Egypt in 1932 and 1937 were increased 10 per cent as an allowance for under-registration. This over-all allowance was distributed by province largely on the basis of Health Bureau indications of under-registration in 1939.

[22] The lowest gross and net rates computed for 1937 (2.39 and 1.19, respectively) were those for Aswân province in Upper Egypt. The highest gross rate (3.62) was that for Gîza in Upper Egypt and the highest net rate (1.80) was that for Damietta governorate.

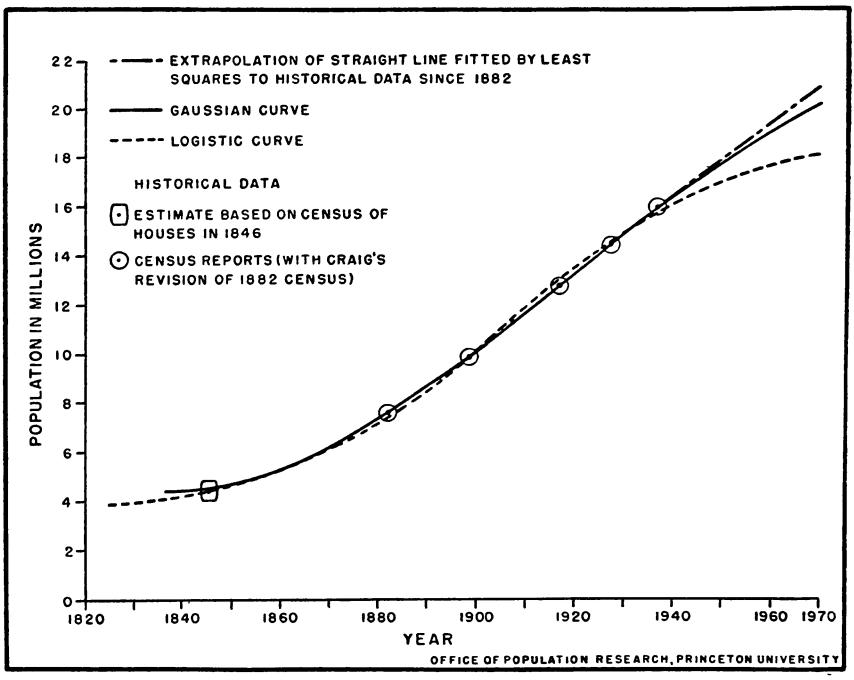

Fig. 10. Projection of Egypt's population to 1970 with three types of growth curves fitted to historical data.

reproduction rate but only a little below with respect to the net reproduction rate. The lower mortality rates tend to compensate the lower fertility rates. Nevertheless, the net reproduction rates of 1.39 for Cairo and Alexandria are high indeed in comparison with those of large cities in Western civilization, which have long been far below the requirements for permanent replacement of the population through births.

The true rate of natural increase, flowing from the computations for the net reproduction rate for total Egypt in 1937, was 12.4 per 1,000 persons per year. The component true birth and death rates were 44.8 and 32.4, respectively. The reproduction rates computed for the year 1932 (G.R.R. 3.03; N.R.R. 1.40) were virtually the same as those for 1937.

Population Projections. Consideration of the net reproduction rates and intrinsic rates of increase leads to questions regarding the

prospects for population growth in Egypt. Several types of population projections were carried out, not with the purpose of arriving at a forecast but rather with the purpose of ascertaining the range of results yielded. The straight geometric increase derived by assuming a stable age distribution and continuation of existing levels of age-specific fertility and mortality yielded a population of about 24 million by 1970. This is a 50 per cent increase over the 1937 population and can probably be safely regarded as an outside maximum that will not be attained.

A second projection was that of arithmetic extrapolation. As already noted, the straight line arithmetic increase has in fact been a conspicuous characteristic of the census figures. The fitting of a straight line to the census figures since 1882 by least squares and projection to 1970 yielded a population of about 20.8 million by that year (*see* Figure 10).

Two types of growth curves have been fitted to the data on the assumption of declining rates of increase. A modification of the Gaussian curve[23] suggested a population of about 20.1 million in 1970. A symmetrical form of the logistic curve[24] yielded a population of 18.1 million in 1970.

The Gaussian curve was found to fit the census points more closely than the logistic, but it should be emphasized that each of these curves has its own theoretical advantages and rational difficulties. Only the future will tell what the population of Egypt will be in 1970. On the basis of the three projections represented in Figure 10, it seems reasonable to expect that it will be between 18 and 21 million.

To draw together the various types of demographic data, we have

[23] This curve is described by the formula $y = a\text{-}be^{-ct^2}$, where a is the upper limit. The writer is indebted to Dr. John von Neumann of the Institute for Advanced Study for his suggestions and help in the application of this formula. He also received helpful advice from Dr. Lowell J. Reed concerning various growth curves.

[24] The symmetrical form of the logistic curve is described by the formula $y\text{-}d = \frac{K}{1+Ce^{-rt}}$, where d is the lower asymptote and K is the difference between the upper and lower asymptotes.

a situation something like this: Within the narrow belt of habitable land of Egypt, there is a closely packed population that has been increasing rapidly despite the heavy toll of mortality. That population is largely Mohammedan and agricultural. It is weighed down by poverty and illiteracy and ridden by parasitic diseases such as hookworm and bilharzia. Although some improvement may be under way, housing and sanitary conditions are still described by writers as deplorable. Some further increase in cultivated land and crop area is possible through further extension of perennial irrigation and through further reclamation of waste land, but the desert imposes sharp limits on this type of expansion. Some further industrialization will doubtless proceed but the lack of fuel and mineral resources is a barrier to substantial progress in this direction.

In short, Egypt is in a demographic jam. With limited room for expansion and no early prospect for substantial decline of fertility, she faces mounting population pressure. Yet, in some respects, her problems are simply accentuations of those confronted by the vast Mohammedan world. Obviously, the implications of these problems are not confined to Egypt nor even to the Moslems. The importance of such a situation of mounting population pressure extends beyond the boundaries of any single country or religious group, for such pressures form a constant threat to world peace.