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RESEARCH NOTE

ABRIDGED LIFE TABLES: AN URBAN-RURAL COMPARATIVE STUDY IN FARS PROVINCE, IRAN

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Résumé — En utilisant les registres funèbres de cimetière de la cité de Shiraz et les données de l'étude pour la région rurale de Mamasani, et en emplpoyant la technique de Fergany et la méthode de Brass pour calculer les valuers de la fonction ${}_nq_x$ pur Shiraz et Mamasani respectivement, notre objectif principal dans cette étude a été de construire des tables de mortalité pour les régions urbaines et rurales dans un pays en voie de développement afin de pouvoir comparer. Les quatre tables construites sont résumées dans la table I. En dépit du fait que les données pour Mamasani se rapportent à 1974 et les données pour Shiraz à 1966, on a constaté que l'espérance de vie à Shiraz est plus élevée d'une façon significative que celle à Mamasani, ce qui montre la disparité générale urbaine-rurale en ce qui concerne les soins médicaux dans les pays en voie de développement. On a constaté que et à Shiraz et à Mamasani, la population féminine a une espérance de vie plus élevée que la population masculine, ce qui met en doute l'opinion générale que le rapport de masculinité élevé en Iran peut être expliqué par la mortalité féminine plus élevvée. Cependant, le grand vide entre l'espérance de vie à la naissance en comparaison avec l'espérance de vie à l'âge de cinq ans pour la population féminine que pour la population masculine, nous a permis de conclure que bien que la population féminine jouisse d'un taux total de mortalité plus bas que la population masculine, la mortalité infantile féminine est plus élevée que la mortalité infantile masculine.

Abstract — Using the cemetery burial records for the city of Shiraz and survey data for the rural Mamasani area, and employing Fergany's technique and Brass's method of calculating the values of ${}_nq_x$ function for Shiraz and Mamasani, respectively, the main objective of this paper has been to construct life tables for urban and rural areas in a developing nation for comparative purposes. The four life tables constructed are summarized in Table 1. Despite the fact that the data for Mamasani relate to 1974 and the data for Shiraz relate to 1966, the life expectancy in Shiraz was found to be significantly higher than that in Mamasani, pointing at the general urban-rural disparity in health care in the developing nations. In both Shiraz and Mamasani, females were found to have a higher life expectancy than males, casting doubts on the generally held view that the high sex ratio in Iran can be explained by higher female mortality. However, the wider gap between the life expectancy at birth as compared with life expectancy at age five for females than for males, has lead us to conclude that although females enjoy a lower total mortality rate than males, female infant mortality rate is higher than the male infant mortality rate.

Key Words — **Life tables, Fergany's and Brass's techniques, urban-rural health care differentials, developing nations**

Introduction

Iran, like many other countries, has been recently paying a great deal of attention to her population problems, particularly with respect to the relationships between demographic and economic variables. Most studies in Iran have concentrated on the issue of fertility and factors determining the family size, etc., but there has been very little research on mortality in Iran. In fact, no complete data have been available to enable the researchers to calculate the exact life expectancy for Iran and its various geographic regions with diverse demographic characteristics and standards of living. The very few estimates regarding life expectancy in Iran are conjectural and/or based on incomplete data. Momeni (1975) constructed life tables for the city of Tehran for the years 1956 and 1966, but his calculations are based on data admittedly characterized by under registration of mortality.

The major purpose of this paper is to construct life tables for the city of Shiraz[1], as an example of urban area, and for Mamasani,[2], as an example of rural area for comparative purposes, using more recent and complete data.

Methodology

Data Collection

The registration of deaths in Iran is incomplete because the legal system is such that a newborn baby need not be registered within the first 15 days of life, and if the baby dies before that time neither the birth nor death will likely be registered. In addition, the two weeks permitted by the law will be extended to several months as a result of violation of this law with the consequences that death registration will remain incomplete in Iran.

Given this situation, the best method to collect relatively-complete information on mortality is to look at the cemetery records, for every dead person will be registered in the books available at the cemetery.[3] In this study the cemetery records were examined in Shiraz for the solar years 1335, 1345, and 1352 (1956, 1966, and 1973).[4] But since the latest available population distribution relates to 1966 census, we have only used the 1966 cemetery burial records to construct life tables for Shiraz. Regarding the Mamasani rural area, unfortunately, not only the death registration is incomplete, but also the cemetery records are not as accurately recorded as those in the urban areas.

Method

A life table consists of six functions, namely ${}_nq_x$, the probability of dying between age x and age $x + n$;[5] ${}_nd_x$, number of deaths between age x and age $x + n$; l_x, number of survivors at exact age x; ${}_nL_x$, years lived between age x and age $x + n$; T_x, total number of years lived after exact age x; and, e^o_x, expectation of life or the average number of years lived after age x. Of these functions, the most important one is the ${}_nq_x$ function, in the sense that once we do have the ${}_nq_x$, all the other functions can easily be calculated. The accuracy of a life table depends very heavily on the accuracy of the ${}_nq_x$ function. Reed and Merrell (1939), Greville (1943), Barclay (1958), Coale and Demeny (1966), Chiang (1968) and Fergany (1971) have introduced various techniques of deriving the ${}_nq_x$. What can actually be observed in real life is the age-specific death rates (${}_nM_x$). Various researchers have transformed the age-specific death rates into ${}_nq_x$, the probability of death, using different formulae. Some of the formulae used are simple and require less assumptions, approximation, or parameter estimation. For this reason, we have used Fergany's method of arriving at the ${}_nq_x$ function according to the formula:

$$ {}_nq_x = 1 - e^{-n^M x\, {}^1x} $$

Where: ${}_nq_x$ is the probability of death; e is equal to 2.714; ${}_nM_x$ is the age-specific death rate; and , I_x is the width of the age group, while, $e^{-n^M x\, {}^1x}$ is the probability of surviving.

We have chosen Fergany's method because it has the advantage that, in comparison with most other techniques of constructing the life tables, it is self-contained in the sense that "beyond making only the assumption of approximating the force of mortality by a step function (which is all we observe anyway) no further assumptions, approximations, or parameter estimates are required to compute all the life table functions" (Fergany, 1971:334). In addition, Fergany demonstrates that the results obtained by this so-called "simple" method are, for all practical purposes, the same as those obtained by Reed and Merrell (1939), Greville (1943), and Chiang (1968). Shiraz's burial records by age at death and the 1966 census age distribution were used to obtain the age-specific death rate for the city of Shiraz.

Because of the fact that in the rural district of Mamasani the burial records are not as reliable as those in the city of Shiraz, we have used different method to arrive at the ${}_nq_x$ function. Brass's (1975) method of arriving at ${}_nq_x$ function for Mamasani has been used.[6] Briefly, this method is based on the relationship between $D(i)$, the proportion of children dead for females in age group i; $f(y)$, the age-specific fertility rate for females in the age group; and, $q(x)$, the probability of death at age x.

$$D(i) = \frac{\int_{z}^{z+5} \int_{I}^{z} f(y).q(x)\, d_y d_x}{\int_{z}^{z+5} \int_{I}^{z} f(y)\, d_y d_x}$$

Where z is exact age of mother, x equal $z-y$ and I is the lower limit of age of reproduction. Given the information on $D(i)$ and $f(y)$, it is a simple matter of estimating the value of ${}_nq_x$ function using the above formula. Brass's method has its limitations in the sense that the estimates of the ${}_nq_x$ are based on the accuracy of reported children ever born and proportion surviving. Also, for high age groups the degree of accuracy of this method of estimating ${}_nq_x$ function is less than that for the lower (below 20) age groups. To overcome these drawbacks of Brass's method, we have used the Gompertz's double exponential equation (Murphy and Nagnur, 1972) to smooth the reported number of children ever born and proportion surviving; and, to overcome the second shortcoming of Brass's method, the Demeny (1971) method of curve fitting has been employed to get more accurate estimates of ${}_nq_x$ from children ever born and proportions surviving for the higher age group.

Results

The four life tables constructed using the aforementioned methods are summarized in Table 1. As can be noted from this table, the life expectancy for the female and the male population of the city of Shiraz were found to be 60.8 and 57.1 years, respectively. That is, based on the 1966 data, Shirazi females expect to live an average of 3.7 years longer than the Shirazi men. The life expectancy differential by sex in Shiraz compares with 4.2 years in Hong Kong for 1960, 5.5 years in Puerto Rico for 1960 and 3.8 years in the Philippines for 1964, showing that, in general, women have longer life expectancy. The census reports have consistently indicated surplus men in Iran in general, and in the cities in particular. For example, while the sex ratio in Iran in 1966 was 107.3, there were 112 males for every 100 females in the city of Shiraz in that same year. Some social scientists have hypothesized that the excess of males in Iran in general is partly due to the higher mortality of females, for there is a strong preference for sons and less care and attention paid to females. The findings of the present research do not support such an hypothesis. The lower male life expectancy, in the urban as well as the rural areas (as can be seen from Table 1), is clear empirical evidence that, contrary to widespread belief of higher female mortality in Iran, the male mortality is higher.

TABLE 1. ABRIDGED LIFE TABLES FOR THE CITY OF SHIRAZ AND MAMASANI (RURAL), BY SEX*

Age	Females		Males	
	$_nq_x$	e^o_x	$_nq_x$	e^o_x
		Shiraz City, 1966		
0	0.13627	60.8	0.12410	57.1
5	0.00896	65.0	0.01044	59.9
10	0.00349	60.5	0.00598	55.5
15	0.00597	55.7	0.00945	50.8
20	0.00846	51.0	0.01292	46.3
25	0.00945	46.4	0.01931	41.9
30	0.01587	41.8	0.01981	37.6
35	0.01639	37.5	0.02566	33.3
40	0.02615	33.1	0.04065	29.2
45	0.03149	28.9	0.04400	25.3
50	0.04017	25.0	0.06854	21.3
55	0.11308	20.7	0.13325	17.7
60	0.12282	18.1	0.15802	15.1
65+	1.00000	15.2	1.00000	12.4
		Mamasani, 1974		
0	0.1225	49.2	0.1442	46.2
1	0.0750	55.0	0.0743	52.9
5	0.0223	55.3	0.0214	53.0
10	0.0173	51.6	0.0161	49.1
15	0.0235	47.4	0.0226	44.8
20	0.0300	43.5	0.0321	40.8
25	0.0339	39.8	0.0353	37.1
30	0.0384	36.1	0.0404	33.4
35	0.0438	32.4	0.0479	29.6
40	0.0478	28.8	0.0593	26.0
45	0.0553	25.1	0.0732	22.5
50	0.0735	21.4	0.0967	19.1
55	0.0975	17.9	0.1272	15.8
60	0.1431	14.6	0.1777	12.8
65	0.2013	11.6	0.2441	10.6
70	0.2958	8.9	0.3393	8.2
75	0.4206	6.6	0.4684	6.1
80+	1.0000	4.5	1.0000	4.3

* In the interest of saving space, all the four life tables are summarized here. This is done by not showing the $_nl_x$, $_nd_x$, $_nL_x$, and T_x functions.

It may also be noted that the life expectancy at age five for both the female and the male population, in the urban as well as the rural areas, is higher than the life expectancy at birth. For the female population of Shiraz the e_5^o is larger than the e_0^o by 4.2 years; the corresponding figure for the male population is 2.8 years. This is typical in the countries where infant mortality rate is relatively high. The higher the infant mortality rate, the greater the difference between the values of e_0^o and e_5^o. Since this difference is higher for the females than for the males in Shiraz, the data provide support for the hypothesis that female infant mortality is higher than the male infant mortality, but the total mortality rate for females is lower than the total mortality rate for males.

Relative to the life tables for rural Mamasani (as can be seen from the lower portion of Table 1), the life expectancy for females was found to be 49.2 years at birth and 55.3 years at age five, whereas the life expectancy for the males was 46.2 years at birth and 53.0 years at age five.

Because the life expectancies calculated for Shiraz relate to 1966 and those for Mamasani relate to 1974, strictly speaking they cannot be compared. In spite of this, however, the following observations are relevant. (1) The life expectancy in Mamasani for 1974 is found to be lower than the life expectancy for the city of Shiraz in 1966. That is, the urban population of Shiraz enjoyed much better health care facilities than the rural Mamasani area eight years later, pointing at the wide urban-rural disparity in health care in the developing nations. (2) In Mamasani, like in Shiraz, the female life expectancy is higher than the male life expectancy, showing higher total mortality rate for males than females. (3) As compared to Shiraz, the difference in the values of e_0^o and e_5^o is much higher in Mamasani. For instance, a gap of 4.2 years for Shirazi females compares with a gap of 6.1 for Mamasani females, and a gap of 2.8 years for Shirazi males compares with a gap of 6.8 for the Mamasani males. These figures indicated that infant mortality in the rural Mamasani area is higher than that of Shiraz. But the infant mortality rate differentials by sex in Mamasani is much less than that of Shiraz. In view of the fact that the difference between the values of e_0^o and e_5^o in Mamasani is greater for males than for females, the findings of this research challenge the common belief that in the rural area of Iran the female babies are less cared for than the male babies. At the very least, this has not been found to be true in Mamasani.

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Footnotes

1 Shiraz is a city located in the southern part of Iran, with a population of 269,865 in 1966 and 425,813 in 1976. Shiraz is the capital of the Fars Province.

2 Mamasani is one of the rural districts of Fars Province. It is located 200 kilometres southwest of the city of Shiraz. The population of the district (Mamasani *Shahrestan*) was 137,974 in 1966, of which more than 92 per cent were classified as rural population.

3 However, this is not the case in the rural areas, where even the cemetery records also remain incomplete or nonexistent.

4 The New Year's Day in Iran corresponds to the first day of spring (20 or 21 March). Roughly, the solar year plus 621 corresponds to the year of Christian era. Thus, the solar year 1352, for example, refers to the period of 20 March 1973 to 19 March 1974.

5 Because of the relation ${}_nq_x + {}_np_x = 1$, we can either use the ${}_np_x$ or the ${}_nq_x$ functions. It is easier to use the ${}_nq_x$ function, however.

6 One may ask as to why we have not used Brass's method to construct the life table for the city of Shiraz. If equally-reliable data were available for both the urban and the rural areas, it would have been much more desirable to employ the same technique of life table construction for both places. Here, the method employed was determined by the availability of what was considered to be the most complete and reliable data. Relative to the city of Shiraz, it was judged that the cemetery records were the best available data, and thus Fergany's technique was employed. The burial records in Mamasani were regarded as too incomplete to enable us to use the Fergany's technique. Therefore, we relied on Brass's method with a different set of data collected through a survey.

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