

A reply to ‘On the Far Eastern pattern of mortality’ by Zhongwei Zhao

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In a paper published in the previous issue of *Population Studies*, Zhongwei Zhao questions the uniqueness of a mortality pattern first identified by Goldman (1980) and subsequently redefined by the United Nations (1982). As originally formulated by Goldman, the Far Eastern pattern is characterized by ‘excessively high’ death rates among older men relative to death rates among *both* younger men and women of all ages. Thus, the Far Eastern pattern has two key features: an atypical age pattern of mortality for males and large sex differences in death rates at older ages. In the original formulation of this pattern, ‘excessively high’ was assessed by the extent of conformity of observed mortality schedules to the Coale and Demeny model life tables (Coale and Demeny 1967). The United Nations (1982) redefined the Far Eastern pattern in their collection of model life tables for less developed countries. The United Nations’ pattern embodies the age pattern described by Goldman for men, but includes populations in which this age pattern is observed among women as well as men.

In his evaluation of the Far Eastern mortality pattern, Zhao does not dispute the fact that the schedules identified by Goldman (1980)—namely, Korea, Hong Kong, Singapore, and Taiwan for various periods between the 1950s and the 1970s—exhibit the key features of the pattern. However, he maintains that this pattern is not distinctive. Specifically, he claims that the same characteristics have been observed in numerous Western populations in the twentieth century.

In the discussion below, I challenge Zhao’s assertion by demonstrating that, according to the criteria set forth by Goldman (1980), the Far Eastern schedules are indeed unique among countries with reliable mortality statistics. They are characterized by larger discrepancies between the mortality of young adult and older adult males and between the mortality of older males and older females than the Western populations identified by Zhao. The weaknesses in Zhao’s argument stem in part from his reliance on graphical displays, which make it difficult to discern patterns, as well as from his use of different criteria

from Goldman (1980) in assessing the extent of discrepancy between observed and model schedules.

Methods of assessing conformity with model schedules

Zhao assesses the degree of conformity to the Far Eastern age pattern of mortality by computing, and subsequently graphing, ratios of age-specific probabilities of dying in an observed population to the corresponding probabilities in a standard (${}_nq_x/{}_nq_x^s$). Given his interest in evaluating the Far Eastern patterns defined by both Goldman and the United Nations, he employs two standards: a Coale and Demeny West model life table and a United Nations Far Eastern model life table. Because of my greater familiarity with the Goldman analysis, I will focus the remainder of the discussion on the use of the Coale and Demeny standard, and thus implicitly on the original characterization of the Far Eastern mortality pattern.

Based on the resulting graphs of the ${}_nq_x/{}_nq_x^s$ values by age, depicted in Figures 1 and 2 of Zhao (2003), Zhao concludes that the mortality ratios for select Western countries are very similar to those calculated for the East Asian ones (Hong Kong, Taiwan, and Singapore): i.e., they all display higher mortality at the older, relative to the younger, ages when compared with the Coale–Demeny model life table. There are two problems with this inference. First, as Zhao himself discusses, some of these schedules are characterized by life expectancies at birth that differ from the standard, thereby weakening the suitability of this ratio as a measure of an age pattern. For example, life expectancies for individual countries in Figures 1 and 2 appear to deviate from those of the corresponding standard schedules by as much as 2 years. Second, and more importantly, there is in fact substantial variation across the patterns revealed by the schedules. However, it is difficult to discern and quantify the degree of discrepancy from the standard without further calculations.

Zhao employs a similar strategy to compare the magnitude of sex differentials in mortality between Western and East Asian populations—i.e., he relies on graphs of ratios of age-specific death rates of males to those of females (Figures 4–13 in Zhao 2003). The resulting ratios are erratic across age and time and render it difficult, if not impossible, to identify distinct patterns.

New calculations

I have performed some simple calculations that underscore the differences between Western and East Asian mortality schedules. These calculations are based on six Western mortality schedules (chosen from the eleven shown in Figures 1 and 2 of Zhao 2003), and four East Asian schedules (the Korean schedule shown in Figure 1 of Goldman 1980 and schedules for Hong Kong, Singapore, and Taiwan selected from among the years shown in Figure 5 of Goldman 1980). The age-specific death rates for males and females that underlie these calculations are taken from United Nations (1961) for Taiwan, Coale et al. (1980) for Korea, and United Nations (2000) for the remaining schedules. For a given schedule, each age-specific death rate is compared with the set of 24 Coale and Demeny West model life tables of the same sex and is assigned the level number that matches the given age-specific death rate;² the resulting level number is typically an interpolation between the two schedules that straddle the rate and is calculated to the nearest tenth. The result of the calculations is thus a series of implied level numbers by age group for each sex, for a given schedule (e.g., Belgium 1969). A relatively constant series of level numbers with age indicates high conformity to the model life tables (i.e., all ages are consistent with the same model life table), whereas progressively lower level numbers at the older ages—for men but not women—are suggestive of the Far Eastern mortality pattern.

The results of this analysis are shown in Table 1a and b for the European and East Asian populations, respectively. In line with Goldman's original focus on adult mortality, the level numbers are presented for age groups 15–19 to 70–74. The results reveal three patterns: (1) schedules for females in both sets of countries are generally consistent with model life tables; (2) schedules for males in both sets of countries do not conform closely to the model life tables; and (3) schedules for males in the East Asian populations reveal a greater systematic deviation from the models than those in the European populations.

The third point, which provides evidence of the distinctiveness of the Far Eastern mortality pattern, can be seen more readily with two additional measures. These measures are prompted by Goldman's original depiction of the Far Eastern pattern as one in which men's death rates (but not women's) show a progressively increasing departure from the level implied by death rates at younger ages (Goldman 1980, p. 8). The first measure, labelled AGE GAP, is obtained as the difference in level implied by death rates of persons (of a given sex) in their 20s (i.e., the average of the rates for age groups 20–24 and 25–29) from the level implied by death rates of those in their 60s (the average for age groups 60–64 and 65–69); death rates for older age groups are not available for some of these countries. Although the use of these specific age groups is somewhat arbitrary, the findings are robust to changes in this definition that are in keeping with Goldman's characterization of the pattern. Values for AGE GAP are shown in the next-to-last rows of Table 1a and b. The second measure, labelled SEX GAP, is obtained as the difference in level implied by death rates for women in their 60s and death rates for men in their 60s. Values for SEX GAP are shown in the last rows of Table 1a and b.

Values of AGE GAP confirm the findings described above. First, they are invariably higher for men than for women. Second, values for males in the European populations (3.9–5.7) are consistently below those for males in the East Asian countries (6.0–13.5). Similarly, the estimates of SEX GAP demonstrate that with one exception—the 1957 schedule for Taiwan—the sex difference in mortality for persons in their 60s is higher in the East Asian schedules than in the European life tables. Although the corresponding estimates for the East Asian countries in more recent decades would be smaller than those shown in Table 1, this phenomenon is a well-established feature of the Far Eastern pattern, i.e., the excess mortality among males in these countries progressively disappeared (Goldman 1980, p. 11).

One additional methodological point is worth noting. Subsequent to the discussion of the age patterns depicted in Figures 1 and 2, Zhao (2003) presents a set of summary measures of discrepancies between the observed and standard schedules. These measures are indices of similarity between the observed age-specific mortality schedules and those implied by the Coale and Demeny model life tables (for each of the four regional families) and by the United Nations model life tables (for each of the five families). Among the nine resulting indices, the one

Table 1 Levels of mortality¹ implied by age-specific death rates and measures of discrepancy from model life tables for the age pattern (AGEGAP) and sex pattern (SEXGAP) for selected populations, by sex

(a) European populations												
Age group	Belgium 1969		England and Wales 1953		Finland 1961		Ireland 1966		Italy 1969		Scotland 1951	
	M	F	M	F	M	F	M	F	M	F	M	F
15–19	21.9	22.8	22.8	22.4	21.3	22.4	23.2	22.8	21.9	22.8	21.7	20.9
20–24	22.2	23.1	22.6	22.4	21.7	23.1	23.1	23.5	22.9	23.1	22.1	20.7
25–29	22.2	22.6	22.4	22.4	21.2	22.9	22.6	22.9	22.6	23.2	21.2	20.6
30–34	22.2	23.1	22.3	22.2	20.6	22.6	22.9	22.6	22.5	23.1	21.0	20.7
35–39	22.1	23.0	22.1	22.1	20.5	21.9	22.0	22.6	22.1	22.8	21.1	20.8
40–44	21.8	22.7	22.1	22.0	19.3	21.8	22.0	22.0	21.7	22.8	20.6	20.6
45–49	21.4	22.4	21.6	22.0	18.8	22.5	22.0	22.3	21.6	22.8	19.5	20.6
50–54	20.3	22.4	20.6	22.0	18.0	22.2	20.9	20.8	21.5	22.9	17.8	20.0
55–59	19.8	22.7	19.7	22.0	17.0	22.0	21.3	21.4	21.4	23.0	16.9	19.3
60–64	18.5	22.7	18.7	21.9	16.3	21.7	19.3	21.0	20.2	22.8	16.0	19.1
65–69	17.5	22.6	18.0	22.0	16.4	21.1	18.6	21.6	19.3	22.9	16.0	17.9
70–74	17.9	22.5	18.1	22.1	17.1	19.3	18.4	20.7	19.4	22.9	15.9	17.3
AGEGAP	4.2	0.2	4.2	0.4	5.1	1.6	3.9	1.9	3.0	0.2	5.7	2.1
SEXGAP		4.6		3.6		5.1		2.3		3.1		2.5

(b) East Asian populations										
Age group	Hong Kong 1961		Korea 1971–75		Singapore 1957		Taiwan 1957			
	M	F	M	F	M	F	M	F		
15–19	22.8	21.6	16.6	17.6	21.6	21.3	20.9	19.9		
20–24	22.4	22.1	18.2	17.7	21.7	21.2	19.6	19.7		
25–29	21.8	21.5	18.9	18.2	22.0	20.5	19.6	19.6		
30–34	21.1	21.4	18.5	18.4	20.2	20.3	19.3	19.5		
35–39	20.7	21.3	18.4	18.7	19.7	19.5	18.9	18.6		
40–44	20.1	21.1	17.0	18.5	18.8	18.0	18.7	18.8		
45–49	19.7	21.6	15.4	18.4	16.4	17.6	18.2	18.9		
50–54	17.3	20.8	12.9	18.2	14.6	17.7	16.8	18.2		
55–59	17.5	21.7	11.8	18.7	12.4	16.4	15.5	18.1		
60–64	13.2	21.5	10.3	18.7	8.6	17.6	14.8	17.3		
65–69	16.0	23.2	9.9	19.9	8.1	17.9	12.4	16.1		
70–74	14.4	23.0	9.6	21.0	10.0	19.0	NA	NA		
AGEGAP	7.5	–0.6	8.5	–1.4	13.5	3.1	6.0	3.0		
SEXGAP		7.8		9.2		9.4		3.1		

¹ West levels of mortality based on Coale and Demeny (1967).

Source: Age-specific death rates by sex are taken from Coale et al. (1980) and United Nations (1961, 2000).

that comes closest to capturing Goldman's definition of the Far Eastern age pattern is based on the Coale and Demeny West life tables. Not surprisingly, in view of the results described above, the two schedules with the highest values on this index are Singapore

(1969–71) and South Korea (1971–75), and three of the four highest values pertain to East Asian populations. Although this index further confirms the distinctiveness of the Far Eastern age pattern of mortality, it differs from Goldman's criteria (and the

measure AGE GAP) in a fundamental way: it essentially compares the mortality level implied by each age-specific death rate with the *median* level, a comparison that is distinct from one based on the difference between the level implied by young adult ages and that implied by older ages. To be more precise, the index of similarity employed by Zhao incorporates the life expectancy at birth (rather than the mortality level) implied by each age-specific death rate, but there is a monotonic correspondence between these two parameters.

Conclusions

I concur with Zhao on several fundamental issues. As he points out, there have been dramatic changes in the age and sex patterns of mortality in many populations. Indeed, as demonstrated by Goldman (1980) and as shown by the estimates for Hong Kong in Zhao's Table 1, mortality patterns in these East Asian populations have converged to those in model life tables and recent schedules fail to reveal either an extreme age pattern or an atypically large sex differential. Thus, as Zhao claims, it is also likely that no population has conformed to a given family of life tables over a long period of time. I also agree that the pursuit of new regional patterns of mortality is unlikely to be a productive endeavour for demographers. However, in closing, I would like to note that the 'discovery' of the Far Eastern pattern was a serendipitous result of a frustrating effort to use model life tables to obtain accurate estimates of mortality for Korean males in the 1970s. Whether or not this pattern of mortality was truly unique, its identification alerted demographers to the deficiencies of the Coale and Demeny life tables for describing mortality experiences outside of the industrialized world, it contributed to the construction of new model life tables for less developed countries, and it inspired several researchers (Elo and Preston 1992; Gragnolati et al. 1999) to explore the extent to which changes in the prevalence of particular diseases may have led to the emergence and subsequent attenuation of this unusual mortality pattern.

Notes

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Princeton, NJ 08540, USA. The author would like to acknowledge Diana Sacke for her invaluable assistance in performing the calculations and Graham Lord for helpful advice.

2 The original collection of Coale and Demeny model life tables (Coale and Demeny 1967) contains 24 life tables for males and 24 for females within each of four families (West, East, North, and South). Within the West family, life expectancies at birth for women range from 20 to 77.5 years across the 24 levels of the life tables, in equal increments of 2.5 years; the corresponding life expectancies for men range from 18.0 to 73.9 years. Thus, the lower the level of the model life table, the lower is the life expectancy at birth. Although Goldman (1980) selected the West family as the most appropriate standard of comparison among the four families, the basic findings presented in Goldman (1980) and in this note would remain unaltered if an alternative regional pattern had been chosen.

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