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THE DIP IN MORTALITY IN THE TWENTIES OF AGE

WALTER G. BOWERMAN

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ROBERT J. RANDALL:

Mr. Bowerman's thesis is borne out by several United States Life Tables which were not cited by him. Examples of such tables occur among the 1939–1941 U.S. Life Tables and the 1910 Tables. Pertinent data on the "dips and troughs" in the twenties in those tables are shown below (Table 1). All of the tables except those for the special groups listed here contain no dip in the twenties.

TABLE 1

U.S. LIFE TABLES

	1939–1941 Tables			1910 Tables	
	Total "Other Races"*	"Other Races"		Negro	
		Males	Females	Males	Females
Age of Maximum Death Rate	24	23	28	22	20
Age of Low Point	26	26	36	25	26
Difference (years)	2	3	8	3	6
Length of Trough	5	6	13	4	10
Percentage of Drop	1.5%	4.5%	4.9%	1.5%	7.1%
Age at End of Trough	29	29	41	26	30

* All except White and Negro.

Mr. Bowerman states that the age incidence of deaths from violence is responsible to a great extent for the dip in mortality in the twenties. This is because death rates from these causes actually decreased by age over a certain range of ages while death rates from all other causes increased by age. When we look at the ratios of deaths from violence to total deaths, the decrease by age is even more apparent. The 1952 report of the Committee on Mortality under Ordinary Insurances and Annuities contains two interesting tables on the causes of death by age group at issue. For medical business, accidents and homicides account for 46.6% of deaths within the first five policy years for issue ages 10–29. This percentage decreases sharply by age at issue to 9.6% for ages 50 and over. For non-medical business, the percentages were 41.3% for ages 10–29 and 2.2% for ages 50 and over.

The periodic reports of the U.S. Census Bureau contain tables of death rates by cause and age. Deaths from violence are classified as homicide, suicide, motor vehicle accidents, and other accidents. It appears from the figures that only deaths from homicide and motor vehicle accidents exhibit the phenomenon of decreases by age in the twenties. Table 2 sets forth the trend in death rates from these causes in recent years.

It is apparent from this table that (1) the proportion of total deaths resulting from these two causes has a maximum in the twenties and decreases by age and (2) in the twenties of age the proportion of deaths resulting from these two causes is increasing year by year. These facts, com-

TABLE 2

TREND OF DEATHS FROM MOTOR VEHICLE ACCIDENTS AND HOMICIDES

Age	Deaths per 100,000								
	Motor Vehicle Accidents			Homicide			All Causes of Death		
	1940	1945	1949	1940	1945	1949	1940	1945	1949
15–19	28.6	23.4	30.3	7.1	4.5	6.6	204.8	152.5	132.1
20–24		31.3			9.9			246.8	
25–29	24.8	23.5	21.8	12.0	11.2	9.7	305.9	261.6	185.3
30–34		18.5			9.6			279.5	
35–39	22.2	18.3	18.3	9.8	10.0	9.1	520.1	386.8	378.5
40–44		19.0			8.6			533.8	
45–49	29.1	19.4	20.2	6.7	7.7	6.6	1,059.9	790.8	871.3
50–54		21.7			5.6			1,160.6	

	Percentage of Total Deaths					
	Motor Vehicle Accidents			Homicide		
	1940	1945	1949	1940	1945	1949
15–19	14.0%	15.3%	22.9%	3.5%	3.0%	5.0%
20–24		12.7			4.0	
25–29	8.1	9.0	11.8	3.9	4.3	5.2
30–34		6.6			3.4	
35–39	4.3	4.7	4.8	1.9	2.6	2.4
40–44		3.6			1.6	
45–49	2.7	2.5	2.3	.6	1.0	.8
50–54		1.9			.5	

bined with the decrease in over-all mortality at all ages, suggest that perhaps the dip in the twenties will become more pronounced in future years if the death rates from all other causes continue to decrease. On the other hand, the improvement in mortality because of medical advances may be approaching the limiting point, and mortality from violent causes may begin to decrease as a result of safety campaigns and similar factors.

The life insurance mortality experience of T.I.A.A. between 1939 and 1952 anniversaries shows a pronounced dip, extending from age 21 to age 35. However, the exposure at these ages was scanty.

ROBERT J. MYERS:

Mr. Bowerman has dealt with a very interesting phenomenon in the realm of life tables. As he indicates, many tables, particularly the older ones, show a peak in mortality rates in the 20's and a decline thereafter until gradually the inevitable rise begins and continues throughout the remaining span of life.

The most striking evidence of this phenomenon occurs in Japanese data. Mr. Bowerman cites what he terms the latest Japanese table, namely, that prepared for the 1930–35 experience of the post office life insurance system. It is of interest to consider other Japanese data, since a complete series of population life tables is available running from the end of the 19th century through the postwar period. A summary for the various experiences is shown in Table 1 (the 7th Life Table for 1945 was not computed on account of incompleteness of data because of the war).

The experience has differed considerably over the years and as between the sexes. In the early years this phenomenon was much more marked for men than for women, and even throughout the later period this tendency persisted to some extent. Furthermore, this phenomenon became more marked as time went by, reaching its zenith perhaps in the 1930's, and subsequently diminishing somewhat. Thus, in the latest life tables mortality is more or less constant between ages 25 and 40, with the drop being only about 10% relatively, as contrasted with figures as high as 30% in some of the earlier experiences.

Mr. Bowerman noted the interesting point that premium rates for short term endowments under the Japanese post office system do not rise steadily with age, but rather dip after age 17. This same phenomenon occurs in the premium rates charged by private insurance companies, all of which are now on a mutual basis and have the same gross premiums. These rates are determined by using the mortality of the 8th Life Table (male), 4% interest, and loading of ¥30 as first year acquisition and ¥7 as annual administrative costs per ¥1,000 of insurance, plus 3% of gross premium as collection cost. As a result, for 10-year endowments, the annual premium for a ¥100,000 policy increases from ¥9,470 at age 10 to

¥9,850 at ages 22–24, and then decreases to ¥9,820 at ages 27–32, after which it gradually rises in what we would consider to be the "accustomed manner."

What is the reason for the dip and trough in mortality rates in the twenties of age? Mr. Bowerman indicates that this can be a result of accidents, tuberculosis, and, for women, childbirth mortality. In Japan, these explanations probably hold true, but principally because of the effect of tuberculosis. In any event, however, we must realize that differences in actuarial technique between the several life tables considered may well produce variations that are more apparent than real. At any rate, it is safe to conclude that the phenomenon considered by Mr. Bowerman is very evident in the Japanese data. Apparently, the current trend due to decreasing mortality from tuberculosis may ultimately result in virtually level mortality in the 20's and 30's, and perhaps this will go even further so that there will be the slowly rising mortality with age that we in this country seem to believe is customary in life tables.

TABLE 1

DATA ON JAPANESE MORTALITY RATES AT AGES 15 TO 49

Life Table	Age of Maximum Death Rate*	Age of Minimum Point	Length of Trough†	Percentage Drop Maximum to Minimum
Post Office, 1930–35, Male	19	33	26	34%
1st, 1891–98, Male	24	29½	9	2%
2d, 1899–1903, Male	22	29	14	10
3d, 1909–13, Male	22	31	17	15
4th, 1921–25, Male	19	32	22	24
5th, 1926–30, Male	20	31	21	26
6th, 1935–36, Male	21	32	22	26
8th, 1947, Male	25	30	17	12
2d Abridged, 1948, Male	26	32	15	14
3d Abridged, 1949, Male	26	32	13	10
1st, 1891–98, Female	‡	‡	‡	‡
2d, 1899–1903, Female	23	27	8	1%
3d, 1909–13, Female	21	30	25	9
4th, 1921–25, Female	21	31½	27	14
5th, 1926–30, Female	21	31	26	16
6th, 1935–36, Female	21	31	25	17
8th, 1947, Female	24	34½	17	10
2d Abridged, 1948, Female	25	32	17	11
3d Abridged, 1949, Female	25	33	13	5

* Maximum death rate in the teens or twenties.

† Years from age for maximum death rate in teens or twenties to later age where this rate is first exceeded.

‡ Does not occur.

R. GRAHAM DEAS:

I have not had sufficient time to go as fully as I should have wished into the material with which Mr. Bowerman has supplied us. I am inclined to wonder, however, if the prolonged decrease in young age mortality cannot be accounted for, at least partially, by statistical errors.

It is possible that in Japan the conditions in the insurance business were not unlike those which prevailed in India when I was there, in the early 1930's. I do not refer to the business written on white lives and those of intermixed races—the number of such policies was inconsiderable and for mortality studies they were kept separate. The business on pure Indian lives was restricted to those who could read and write the English language. This meant that we were dealing with the relatively well educated type of Indian—in those days they represented perhaps 1% or 2% of the population.

The errors in age were nevertheless enormous when judged by American or British standards. It has always been a difficult matter to obtain well documented evidence of age in countries such as India, and very often the problem was left over until the policy became a claim. If the policy was a maturing endowment the sum insured would probably be paid without insisting on having the age proved, but the best available evidence was required for death claims. The best available evidence was seldom very good! Quite often it took the form of a declaration by some responsible person—perhaps a schoolmaster of the deceased or the head man of his native village.

On death claims errors in age of five years were common and we were not unduly surprised by an error of ten years. The ages, needless to say, were almost invariably understated. It is possible, of course, that the part-time agency force did not exert themselves unduly to prevent such misstatements. My impression is that, over the total business in force, the ages might have been understated, on the average, by perhaps two or three years.

I distinctly remember, also, a glaring error that arose, not in India, but in Trinidad. The policy was effected in connection with an endowment insurance pension plan, the pension being payable from age 65. The applicant's age at entry was stated to be 52, but when he died a few years later it transpired that his age had been understated by no less than 15 years and that he had actually been over pension age when his policy was effected. In this case it seemed that his misstatement had not been deliberately designed to defraud the insurance company; his object, rather, had been to make himself appear more eligible for the job for which he was applying.

If conditions like these hold, to any extent, in Japan, or elsewhere, the position, in a mortality investigation, will be that the deaths are recorded at the correct age (approximately) while the exposed to risk are really of an older average age than stated. The actual effect of this on the mortality rates would depend, of course, on the age distribution of the business. A recently established or rapidly growing company will naturally tend to have a large proportion of its business on young lives. It is possible that in such a company the exposed to risk would decrease within the range of ages at which mortality rates are decreasing. The effect of age errors on such data could be considerable. I believe that, in certain circumstances, they could actually cause an apparent decrease in mortality where, in fact, the true rates are increasing. On the other hand, I am sure that with other distributions of the exposed the effect could be in the opposite direction—I merely mention the former as a possible explanation of the remarkable phenomenon of the persistent decrease in mortality.

Much depends, of course, on the original data and how it was grouped for graduation. We are all familiar with the different effects of different groupings of the same data on graduated mortality rates. I imagine that age errors could increase these differences. And, of course, in the foregoing remarks I have assumed the errors to be in the exposed only, not in the deaths. If the ages of the deaths are also incorrect, other considerations arise.

I am sorry that I no longer have access to the information regarding age errors on which my remarks have been based. Consequently I cannot prove or disprove my own or anybody else's theories. I agree with Mr. Bowerman that the subject is worthy of investigation. In my opinion, the reliability of the basic information should be given due consideration. Statistics from some parts of the world, especially those based on ages, cannot always be regarded as being as well authenticated as if they had been compiled in this country.

(AUTHOR'S REVIEW OF DISCUSSION)

WALTER G. BOWERMAN:

War mortality should be mentioned and kept in mind. However, it would likely make a "bulge" rather than a "dip" in the twenties of age. It does not seem to have entered any of the tables named in the paper or the discussions.