

Determinants and Consequences of Mortality Trends in Ceylon

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THE DEATH RATE in Ceylon declined from 19.8 to 14.0 per 1,000, or 29 percent, in the year from 1946 to 1947. Being most abrupt, this decline in the death rate has given rise to postulations that advances in public health techniques permit significant reductions in the death rate, independently of economic development. Thus, the application of public health measures would increase the rate of population growth and thereby reduce the per capita income, assuming that the birth rate remains constant and economic development lags. Frequently cited (1-5), such postulations may have been accepted as descriptive of the relationship between health and economic development in underdeveloped areas. However, these hypothetical determinants and consequences of mortality trends in Ceylon are not confirmed by the sequence of events.

It was once accepted that control of malaria, through the application of insecticides, was primarily responsible for the postwar reduction in the death rate in Ceylon. This conclusion is not confirmed by the findings that the most precipitous decline in mortality had preceded large-scale application of insecticides and that the decline in mortality in the malarious area and the unprotected, nonmalarious area of the island had been about the same (6). Indeed, the net demographic effect of malaria control, which has made a major part of the island habitable, may be a reduction in population pressure.

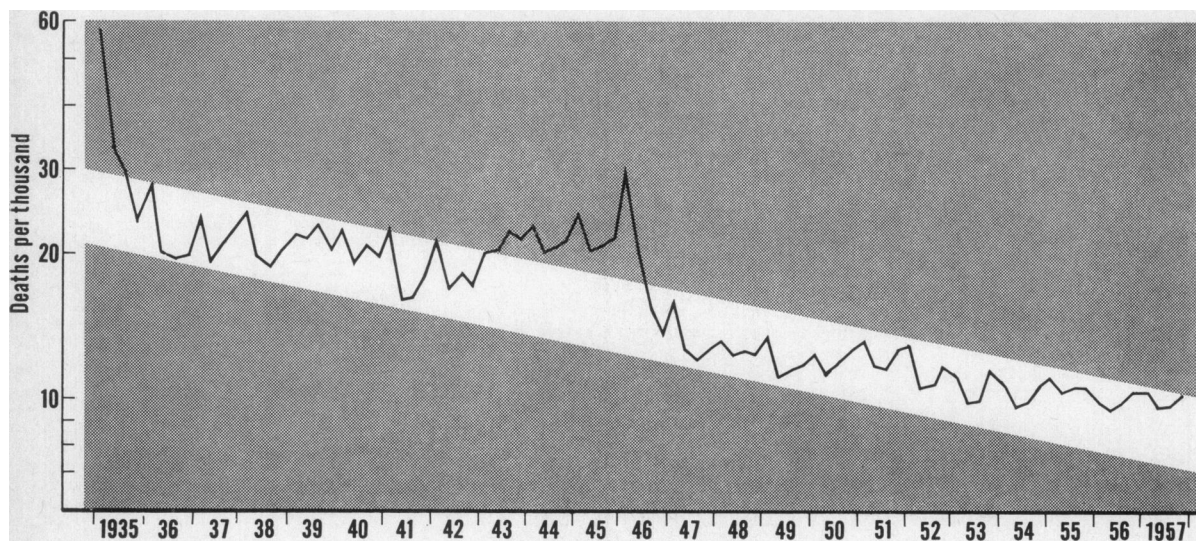
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The death rate of Ceylon has displayed a long-term downtrend, despite a step-by-step improvement in the reporting of deaths. The downtrend was interrupted in 1935, when a disastrous drought resulted in a sharp rise in mortality. A semilogarithmic plot of the death rates for the quarters of the years since the great drought in 1935 through 1957 indicates a fairly constant rate of decline in the quarterly death rates, with a wartime interruption of the downtrend and a postwar return to the prewar downtrend (fig. 1). It seems the wartime rise in mortality, rather than the postwar decline, may have been the notable event.

The wartime rise in mortality suggests that circumstances arising from the war may have exacerbated one of the major public health problems. Malnutrition and malaria have been ranked as the two foremost health problems in Ceylon. Having ruled out malaria control as the primary cause of the postwar decline in mortality, the level of nutrition was examined for fluctuations which may have influenced the death rates to rise during the war and return to the long-term downtrend following the war.

It was found that the wartime rise from 1943 to 1946 and the postwar decline in the death rate were associated with the development and alleviation of a wartime food deficit (table 1). The timing and extent of the deficit are indicated by the wartime decline in food imports which represented the principal source of food for Ceylon. The existence of reserves might have delayed any significant effects of the decline in food imports until 1943. Following the war, food imports rose and by 1947 exceeded

Figure 1. Death rates by quarter, Ceylon, 1935-57

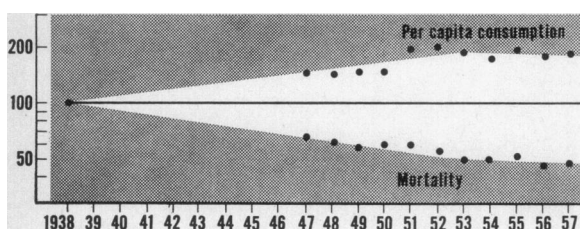


SOURCES: Reports of the Registrar General on Vital Statistics, Ceylon.

the prewar level. The extent of wartime malnutrition and postwar recovery is indicated by the significant increase in weights of school children between 1945 and 1950 (table 2).

Although extraordinary events, such as drought or war, have been accompanied by marked deviations from the long-term trend of the death rates, attempts to isolate and measure the effects of specific causes of death or specific measures of survival on the trend of the death rates may be futile or fallacious, at least until the reporting of specific causes of death and indices of economic development provide more specific, accurate, complete, and comparable data. Since data are lacking to exclude the effects of all other factors, the precise or even relative importance of the wartime food shortage as a cause of death can not be conclusively established. Nevertheless, the available data

Figure 2. Indices of personal consumption per capita at 1938 prices and mortality rates, Ceylon, 1947-57 (1938=100)



SOURCE: Table 4.

support consideration of malnutrition as a factor in the wartime rise in the death rate.

The relationship between mortality trends and level of living, at least in the phase of

Table 1. Mortality rates, governmental health expenditures, and imports of food and other consumption goods, Ceylon, 1938-47

Year	Mortality rate per 1,000 ¹	Per capita imports at 1938 prices ²		Per capita governmental health expenditures at 1938 prices ³
		Food (rupees)	Other consumption goods (rupees)	
1938.....	21.0	17.6	7.8	2.2
1939.....	21.8	18.4	7.5	2.1
1940.....	20.6	17.2	7.7	2.0
1941.....	18.3	17.0	6.5	1.9
1942.....	18.1	13.8	4.5	1.5
1943.....	20.8	13.7	5.6	1.3
1944.....	20.8	15.8	6.5	1.5
1945.....	21.5	15.5	6.9	1.5
1946.....	19.8	16.6	6.6	1.9
1947.....	14.0	19.0	7.4	2.2

¹ Provisional corrections in the population estimates and rates for 1941 and subsequent years have been made for underenumeration of children in the 1946 and 1953 censuses.

² As computed by the Ministry of Finance.

³ Based on the cost of living index.

SOURCES: Ministry of Finance, Economic and Social Development, 1926-1954, Ceylon, July 1955, and Reports of the Registrar General on Vital Statistics, Ceylon, and Statistical Abstracts of Ceylon.

Table 2. Average weights (pounds) of boys and girls, Ceylon, 1945 and 1950¹

Age (years)	Boys		Girls	
	1945	1950	1945	1950
6.....	35	38	34	37
7.....	39	40	38	39
8.....	42	44	41	43
9.....	46	47	45	47
10.....	48	52	48	52
11.....	51	55	52	57
12.....	53	59	56	63
13.....	61	66	65	72
14.....	64	75	70	79
15.....	74	84	81	88
16.....	80	92	87	90
17.....	86	101	89	94
18.....	93	107	92	95

¹ Based on surveys of schools in representative areas of the island.

SOURCE: Administration Reports of the Director of Health Services, Ceylon.

transition in Ceylon, may be indicated by a comparison of the trend of mortality and the per capita allocation of gross national product for personal consumption at constant prices. Although comparable data are lacking for the war years, it is evident that personal consumption and mortality rates have displayed an inverse association (fig. 2).

Improvements in the whole range of economic indices were more or less concurrent with the

decline in the death rate (tables 3, 4, and 5). Comparisons of the direction and timing of changes in economic indices suggest sectors that have been leading or lagging in the transition (table 4). Thus, in 1947, when the death rate had returned from a wartime peak to the previous downtrend, per capita consumption at constant prices had risen sharply above the level of 1938, whereas per capita health expenditures had remained at the level of 1938. In subsequent years, per capita health expenditures and personal consumption rose concurrently with the decline in the death rate. Moreover, as remittances abroad were curtailed, the rate of capital formation was increased to a remarkable extent (table 5). Capital formation at the rate of 12 and 13 percent of the gross national product exceeds the rate of investment in most underdeveloped countries and compares favorably with that in Europe.

If the sequence of events in Ceylon had demonstrated that economic development is no longer a prerequisite for a decline in the death rate, it might have seemed plausible to postulate that modern public health measures would tend to reduce per capita income as well as mortality, with the possible inference that per capita income would rise with a rise in mortality. But the postulation of such consequences of mortality trends is not confirmed by the experience of Ceylon, where a decline in

Table 3. Gross national product, Ceylon, 1938 and 1947-57

Year	Gross national product at current prices (millions of rupees)	Cost of living index (1938=100)	Gross national product at 1938 prices ¹ (millions of rupees)	Population (thousands)	Gross national product per capita at 1938 prices ¹ (rupees)	Index of gross national product per capita at 1938 prices ¹ (1938=100)
1938.....	656	100	656	5,826	113	100
1947.....	2,409	252	956	7,044	136	120
1948.....	2,762	260	1,062	7,251	146	129
1949.....	2,967	258	1,111	7,476	149	132
1950.....	3,501	272	1,287	7,688	167	148
1951.....	4,619	283	1,632	7,885	207	183
1952.....	4,507	281	1,604	8,088	198	175
1953.....	4,491	286	1,570	8,302	189	167
1954.....	4,748	284	1,672	8,519	196	173
1955.....	5,234	282	1,856	8,729	213	188
1956.....	5,096	281	1,814	8,945	203	180
1957.....	5,200	289	1,799	9,172	196	173

¹ Based on the cost of living index.

SOURCE: Statistical Abstracts of Ceylon.

mortality has been associated with development of the economy and rise in the level of living.

The question remains whether a decline in the birth rate will follow the rise in the level of living and the decline in the death rate or whether there will be a fundamental difference in the interaction of economic and demographic transition in Ceylon and the West. In the course of Western civilization, a decline in mortality has been observed as a concomitant of the rise in per capita income and as a precursor of the decline in the birth rate (1,2,4,5). There have been some doubts whether a similar relationship between the death rates and birth rates will be observed in underdeveloped areas, where postwar reductions in mortality had been considered to be exclusively or largely the result of specific public health measures and quite independent of economic development (4,5).

The birth rate of Ceylon has declined from a postwar peak of 39.8 to 35.8 per 1,000 population in 1958, when the districts of Ceylon displayed considerable variation in the level of the birth rates. In 1958, the birth rates in the districts ranged from 53.6 to 25.4.

Data for the 21 districts of Ceylon suggest a relationship between the level of the death rates and the subsequent level of the birth rates.

Table 5. Allocation of the gross national product, by percentages, Ceylon, 1938 and 1947-57

Year	Personal consumption	Government expenditures		Remittances abroad	Capital formation	Increase or decrease in assets abroad ¹
		Health	Other			
1938	69.1	1.9	12.5	13.9	5.9	-3.4
1947	83.6	1.6	11.7	5.2	5.4	-7.5
1948	74.6	1.9	10.8	5.4	6.3	0.9
1949	73.8	2.0	11.3	4.6	9.3	-1.0
1950	69.0	1.8	10.5	5.5	9.0	4.2
1951	71.7	1.5	7.4	5.0	12.0	2.4
1952	78.5	1.9	8.6	5.2	13.5	-7.7
1953	77.0	2.0	9.9	3.8	12.4	-5.1
1954	68.4	1.9	9.4	3.6	10.5	6.1
1955	68.3	1.8	9.0	4.1	11.9	5.0
1956	68.1	2.0	11.4	4.4	13.6	0.5
1957	73.4	2.2	11.6	3.9	13.4	-4.5

¹ As percent of gross national product.

SOURCE: Statistical Abstracts of Ceylon.

Comparison of the death rates in 1938 and the birth rates in 1958 demonstrates the remarkable correlation (table 6). Low death rates or conditions underlying low death rates merit consideration as contributory factors, if not as prerequisites, for low birth rates.

At this time, the districts of Ceylon with the lowest birth rates are characterized by the great-

Table 4. Mortality and economic indices of personal consumption, health and other governmental expenditures, remittances abroad, gross capital formation, and gross national product, Ceylon, 1938 and 1947-57

Year	Mortality		Per capita indices at constant prices (1938) ¹					
	Rate per 1,000	Index	Personal consumption	Government expenditures		Remittances abroad	Gross capital formation	Gross national product
				Health	Other			
1938.....	21.0	100	100	100	100	100	100	100
1947.....	14.0	67	146	99	113	46	110	120
1948.....	13.0	62	141	130	113	51	137	129
1949.....	12.4	59	146	140	123	46	213	132
1950.....	12.4	59	149	141	125	59	225	148
1951.....	12.7	60	191	143	108	67	372	183
1952.....	11.8	56	200	171	121	67	400	175
1953.....	10.7	51	187	172	133	46	351	167
1954.....	10.2	49	173	175	131	46	309	173
1955.....	10.8	51	187	173	135	56	378	188
1956.....	9.8	47	178	186	164	57	412	180
1957.....	10.1	48	185	198	162	49	393	173

¹ Based on the cost of living index.

SOURCES: Statistical Abstracts of Ceylon and Reports of the Registrar General on Vital Statistics, Ceylon.

Table 6. Correlation between the death rates in 1938 and birth rates in 1958 in 21 districts of Ceylon

Death rates per 1,000 inhabitants	Birth rates per 1,000 women 10-49 years of age				Total districts
	90-119	120-149	150-179	180 and over	
10-19-----	5	3	0	0	8
20-29-----	2	2	2	0	6
30 and over---	0	0	3	4	7
Total districts-----	7	5	5	4	21

SOURCE: Reports of the Registrar General on Vital Statistics, Ceylon.

est density of population or urbanization, the highest literacy rates, and the highest mean age of females at marriage, as well as the lowest death rates. Reductions in the birth rate may be experienced in all districts of Ceylon as the factors underlying the low birth rates in some of the districts are extended islandwide.

The associations between economic and demographic indices suggest cause and effect relationships. However, postulation of the precise nature or direction of the causal relationships

may tend to be an oversimplification of a complex process of interaction between multiple causes and multiple effects. Improvement in one index of economic or demographic transition may tend to be associated with improvement in all indices through a process of concurrent and cumulative causation. Thus, economic and demographic transition may tend to be parts of an integral system in which arbitrary indices of welfare and well-being may be mere aspects of one underlying reality.

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UCLA School of Public Health

Graduate programs of the newly established School of Public Health at the University of California at Los Angeles will be conducted in biostatistics, environmental health, epidemiology, public health administration, general hospital and mental hospital administration, medical care administration, occupational health, public health education, and public health nutrition. The graduate degrees offered are the master of public health, master of science in public health, doctor of public health, and doctor of philosophy in biostatistics. The programs have been accredited by the American Public Health Association.

The school offers field training with public health agencies and a variety of scholarships and fellowships.

Further details are available from: Dr. L. S. Goerke, Dean, School of Public Health, University of California at Los Angeles.

Elderly Studied in Florida

A large transplanted population of elderly people, mostly white, Protestant, relatively well educated, married, and retired, with better than average incomes, characterizes St. Petersburg, Fla., and surrounding Pinellas County, according to a recent survey of the area. This survey, which covered a 3.5 percent sample of persons 65 years old or over, is the first phase of a comprehensive study of public health needs and services conducted by the county health department. Findings for the most part are corroborating the prevailing impression of this community, long known throughout the world as "a desirable place for retired persons to live."

The over-representation of the aged in Pinellas County is clearly established. The 1950 U.S. census reported that 18.8 percent of the residents were 65 years of age or over, compared with a national average in that year of 8.1 percent. (According to advance reports of the 1960 census, the proportion of persons 65 years old or older in Pinellas County was 24.9 percent.)

Distribution of the elderly population by age differs little from that estimated in the Nation in 1959. The county has, however, a greater concentration of persons from 70 to 74 years of age.

The population of Pinellas County 65 years old and over is predominantly white; less than 3 percent are nonwhite. The ratio of men to women is relatively high, with 97 men per 100 women, which contrasts sharply with the official estimate for the United States of 83 men per 100 women in the age group studied.

The educational level of Pinellas County's older people is considerably higher than that of their national counterparts. National census figures for 1952 are higher for those with no formal education and with only elementary education but lower for those who have completed 1 or more years of high school and college. Since the elderly in the county are mostly migrants from other States, it appears that interstate movement to this area has selected persons with more education.

Pinellas County's aged population appears to be better off financially than other older people in the Nation. About 14 percent had annual family incomes greater than \$5,000 for the year preceding the interview, 21 percent were paid more than \$3,000 but less than \$5,000, and 24 percent received

more than \$2,000 but less than \$3,000. More than one-tenth reported either a loss or less than \$1,000 income, and more than one-fifth received less than \$1,500.

The marital status of Pinellas County's elderly differs sharply from the national norm. Both men and women tend to a much greater extent to be married and not widowed. This suggests that long-distance migration consists mainly of married couples, and further study may indicate a tendency for a surviving spouse to leave the county.

Most of the persons studied are "retired," and are migrants from other States. Only one-tenth were engaged in paid employment: for white men the figure was less than 12 percent and for white women it was even lower. Although more than 90 percent of the men considered themselves retired, more than two-thirds of the women said they were "not retired," a reflection of their continuing function as housewives.

Most of the elderly persons in the county have spent the major share of their lives in other States. A third have been Florida residents for less than 5 years, and this proportion is probably understated because of a residence requirement for inclusion in the sample (since July 1, 1958). Nearly two-thirds have lived in the county less than 10 years, less than 1 percent are lifelong residents, and only 16 percent are residents of 20 years or more. Apparently migration often occurs at advanced ages. Of the 228 persons aged 80 through 84 more than a fifth have been residents less than 5 years, and two-fifths less than 10 years.

This pattern of migration into the county at or near retirement ages is characteristic almost exclusively of the white population. Nonwhites, principally Negroes, usually have lived in the area for long periods.

These findings are taken from a paper by Irving L. Webber, Ph.D., research social scientist, Pinellas County Health Department, St. Petersburg, given at the 10th Annual Southern Conference on Gerontology, Gainesville, Fla., March 17, 1961. The full paper is included in the report of the conference, "Aging: A Regional Appraisal," edited by Carter C. Osterbind, Ph.D., published in June by the University of Florida Press.