

Commentary

How Many Die? A Set of Demographic Estimates of the Annual Number of Infant and Child Deaths in the World

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Abstract: Estimates concerning the annual number of infant and child deaths in the world range from around 15 million to well over 30 million. Although infant and child mortality is difficult to measure with any precision, the range of uncertainty can be narrowed considerably through the application of standard demographic techniques to readily available population data. A set of estimates based on the most recent and

authoritative data compilations points to a range of from 12–13 million to about 17–18 million infant and child deaths annually during the late 1970s, with an average of around 15 million. On the basis of what is known about mortality conditions of the world today, a figure much larger than the 17–18 million at the high end of this range would be extremely difficult to substantiate. (*Am J Public Health* 1980; 70:1286–1289.)

Introduction

Recent statements by world leaders illustrate the confusion that currently exists about the number of infants and children who die. In October 1979, for example, Robert McNamara told the members of the World Bank's Board of Governors that, "the United Nations Children's Fund (UNICEF) estimates that more than 30 million children under the age of five died of starvation just last year."¹ Since there were no doubt numerous infant and child deaths in 1978 other than those resulting from starvation, the total number of deaths implied by the UNICEF/McNamara estimate would be much larger than the 30 million figure given. But others read the UNICEF figures differently and cite far lower numbers. In his December 1979 introduction to the Independent Commission on International Development Issues which he chaired, for instance, former West German Chancellor Willy Brandt wrote that, "the United Nations Children's Fund (UNICEF) estimated that in 1978 alone more than 12 million children under the age of five died of hunger."² Elsewhere, speaking of deaths from all causes, the Brandt Commission estimated that "between 20 and 25 million children below the age of five die every year in the developing countries."³

While well below the figure appearing in Mr. McNamara's speech, even this number is significantly higher than that referred to by United States President Jimmy Carter, who said in May 1978 that, "each year more than 15.5 million children, nearly all of them in the developing countries, die before they reach the age of five."⁴

The large differences among the figures cited by such leading statesmen suggest the existence of a great deal of confusion in high policy circles concerning the number of infant and child deaths that occur. To some extent, this is understandable, since the number of infant and child deaths cannot be known with any certainty. The data available are not adequately complete or reliable for that. But neither is the degree of ignorance concerning mortality levels nearly so complete as to necessitate a continuation of such extreme uncertainty, for readily available demographic data and techniques permit the calculation of a reasonable range of estimates considerably narrower than that now in evidence.

Demographic Estimates

Several computational approaches, all of them producing essentially similar results, are available. One of the more straightforward ones begins by calculating the approximate number of births occurring annually during the late 1970s, and by estimating the proportion of those born who died before reaching their fifth birthdays. The number born is then multiplied by the proportion dying to produce an estimated

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TABLE 1—Recent Estimates of World Population Size, Crude Birth Rate, and Life Expectancy Level

Organization	Reference Period or Date	World Population (billions of people)	World Crude Birth Rate (per 1,000 population)	World Life Expectancy at Birth (years)
United Nations	1975–80 Average	4.23	28.9	57.6
U.S. Census Bureau	1975–80 Average	4.12	28.8	61.1
World Bank	Mid-1977	4.34	31.5	59.6
AVERAGE		4.23	29.7	59.4

SOURCES: United Nations, Department of International Social and Economic Affairs, Population Division: World Population Trends and Prospects by Country, 1950–2000: Summary Report of the 1978 Assessment (ST/ESA/SER.F/33), 1979.

United States Department of Commerce, Bureau of the Census: Current Population Reports: Illustrative Projections of World Populations to the 21st Century (Special Studies Series P-23, No. 79), 1979.

The World Bank: World Development Report, 1979. Washington, DC: The World Bank, 1979.

number of deaths occurring among infants and children under five years of age.*

The annual number of births, the starting point of this approach, can be estimated by multiplying the number of people in the world by the average number of births per person—that is, the world population size by the world crude birth rate. The necessary population and birth rate figures are available from numerous standard sources. If for the sake of convenience the arithmetic averages of the three estimates cited in Table 1 are accepted as reasonable, then the world's population would be 4.23 billion, the crude birth rate 29.7 births per 1,000 population, and the resulting average annual number of births 125.6 million.

In the absence of accurate published age-specific death rates for the world as a whole, the proportion of these 125.6 million newborns dying before age five must be estimated indirectly. This can be done by applying to the available information about global overall mortality levels a set of estimates, based on the experience of countries with reliable data, concerning the way in which mortality is distributed among different age groups.

Estimates of overall mortality levels, expressed in terms of life expectancy at birth, have been prepared by the same three organizations whose population size and crude birth

rate figures were cited earlier. As can be seen from Table 1, the average worldwide life expectancy estimate is 59.4 years.

Information about the age pattern of mortality in the world as a whole during the late 1970s, needed to identify the infant and child mortality probabilities associated with this world life expectancy of 59.4 years,** is not available. Reliance must be placed instead on the considerable body of knowledge about the distribution of mortality by age in those countries with relatively reliable data collection systems at a time when their life expectancies were at about the world's present level.

The most widely used compilation of data on the age distribution of mortality in such countries⁵ identifies four distinct patterns. In the Western European and non-European areas covered, the distribution was such that when life expectancy at birth was 59.4 years, the infant mortality rate was around 73 per 1,000 live births, and 30 of every 1,000 children one year of age died before reaching their fifth birthday. In Southern Europe, the proportion of total mortality occurring at early ages was considerably higher. There, the infant mortality rate associated with a life expectancy of 59.4 years was about 96, and the probability that a one-year-old child would die before the age of five was 46 per 1,000. In between these two extremes were the patterns observed in Eastern and in Northern Europe.

While no one of these patterns is likely to describe precisely the situation prevailing in the world as a whole during the late 1970s, the available demographic evidence suggests that the age distribution of mortality in most countries lies somewhere within the broad range outlined by the four taken together. This being the case, a pair of estimates—one based on the just-cited infant and child probabilities of the Western European/non-European pattern, the other on those of the South European pattern—can be used with at least a modest degree of confidence to demarcate the outer bounds of a

*An alternate approach would be to calculate first the total number of deaths (world population times crude death rate); next to work out the distribution of these deaths by age for the stable population characterized by the appropriate overall mortality level and population growth or fertility rate; and then to multiply the number of total deaths by the proportion accounted for by deaths among infants and children. A second alternative would be to estimate first the proportion of the population composed of infants and children aged 0–5 in a stable population with the same demographic characteristics as those now prevailing in the world. These proportions, when multiplied by the total population size, would yield estimates of the absolute numbers of infants and children; and multiplying the resulting figures by mortality rates from the appropriate model life tables would produce an estimated number of infant and child deaths. *Ceteris paribus*, use of these somewhat more cumbersome approaches yields a range of estimates of the number of infant and child deaths with a midpoint slightly but not significantly lower than that produced by the procedure described in the text.

**The level of life expectancy at birth by itself provides only limited guidance concerning infant and child mortality probabilities since a society with a relatively low infant mortality rate could, if this low infant rate were compensated for by higher adult mortality, have the same life expectancy at birth as a society experiencing significantly higher mortality among infants.

TABLE 2—Average Annual Number of Infant and Child Deaths, World as a Whole, 1975–80

	"West" Pattern (in millions)	"South" Pattern (in millions)
Number of Births*	125.6	125.6
Proportion of those born dying before first birthday**	.073	.096
Number of Infant Deaths (line 1 × line 2)	9.2	12.1
Number of Infants Surviving to Age One (line 1 – line 3)	116.4	113.5
Proportion of those alive at age one dying before fifth birthday***	.030	.046
Number of Child Deaths (line 4 × line 5)	3.5	5.2
Number of Infant and Child Deaths (line 3 + line 6)	12.7	17.3

*4.23 billion world population (Table 1) × 29.7/1000 crude birth rate (Table 1).

** ${}_1q_0$ value corresponding to life expectancy at birth of 59.4 years (Table 1), interpolated arithmetically from Coale-Demeny model life tables.

*** ${}_4q_1$ value corresponding to life expectancy at birth of 59.4 years (Table 1), interpolated arithmetically from Coale-Demeny model life tables.

range within which, on the basis of present knowledge, the true figure seems likely to lie.

The results of applying these probabilities of death to the 125.6 million annual births mentioned earlier are shown in Table 2. In each case, the 125.6 million annual births are first multiplied by the appropriate infant mortality rate to produce an estimate of the number of those born who die before reaching an age of one year. The number of survivors is then multiplied by the equivalent of the infant mortality rate applicable to the age group one through four, the result being an estimate of the number of deaths among children between one and five years of age. These two categories add up to a total of 12.7 million annual infant and child deaths according to the "West" pattern, to 17.3 million infant and child deaths when the "South" pattern is used.***

Conclusion

In brief, the application of standard demographic techniques to the most recent world population data available produces a range of estimates of the average annual number of infant and child deaths between 1975 and 1980 in the world as a whole that runs from about 12–13 million at the low end to 17–18 million at the high, with an average of around 15

***The use of other data (such as the United Nations, U.S. Census Bureau, or World Bank data alone, instead of the averages of the three), the application of different model life tables, and/or reliance upon alternate computational methods such as those described in the initial footnote yield results somewhat different from these. A series of experimental calculations suggests that, with adequate computational ingenuity and extreme assumptions, figures as low as 10–11 million and as high as 19 million deaths can be obtained. But most of the estimates produced by other data and alternate approaches lie within the range of 12–13 million to 17–18 million deaths suggested by the results presented in Table 2.

million.† The width of this range indicates that the considerable uncertainty concerning the true number of deaths has by no means been completely eliminated by the approach used. This being said, however, such estimates strongly suggest that, on the basis of what is known about mortality conditions in the world today, it would be extremely difficult to substantiate a figure much larger than 17–18 million infant and child deaths annually.

Too much could easily be made of this kind of numbers game, to be sure. Even 12–13 million infant and child deaths is still an appalling number, especially when it is realized that well over one-half of them ought to be avoidable in the sense that they would not occur were the favorable mortality conditions of the West to prevail in the developing world as well.†† Also, the important question is not nearly so much the number of deaths that occur, but rather how that number can most effectively and most rapidly be reduced.

If effective reduction efforts are to be developed, though, realistic empirically-based assessments of the magnitude of the task ahead will be required. For this reason, one can only

†We find that 95–97 per cent of these deaths occur in the less developed regions, according to calculations analogous to those outlined in Table 2 using UN data for the developed and for the developing countries taken separately instead of data for the world as a whole. Also, the use of UN time series data in comparable computations shows the number of infant and child deaths to have been falling slowly (by about 0.4–0.7 million between 1970–75 and 1975–80, for example) rather than rising as the decline in infant and child mortality rates has continued to be significant enough to more than offset the increase in the number of infants and children caused by population growth.

††Computations undertaken under the assumption of no change in fertility suggest a reduction in the number of infant and child deaths by approximately 60–75 per cent when the 1975–80 mortality levels of the more developed regions are used in place of those of the world as a whole in the calculations of Table 2. Use of developed country fertility as well as mortality levels leads to an 80–90 per cent reduction in the number of infant and child deaths.

hope that statements about 20 million, 30 million, or more infant and child deaths annually will soon disappear from current and prominent usage, to be replaced by more careful estimates that can be of value for program planning purposes.

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Area Health Resource Reports Available

The Bureau of Health Professions, Health Resources Administration, has recently published a series of 51 separate reports containing health resources and sociodemographic information for Health Service Areas and counties within each state. The reports were prepared for use by state and local planners, Health Systems Agencies, researchers, and others engaged in health planning, analysis, and research. These reports, prepared in early 1979, include data available at that time.

Copies of the reports have been sent to all HSAs, state health coordinating councils, state health planning and development agencies, and centers for health planning.

Others may purchase the reports from the National Technical Information Service, US Department of Commerce. Further information is available from: National Health Planning Information Center, Center Building, Room 5-22, 3700 East-West Highway, Hyattsville, MD 20782.