

Symposium: Accomplishments in Child Nutrition during the 20th Century

Infant Mortality in the 20th Century, Dramatic but Uneven Progress¹

Myron E. Wegman

School of Public Health, University of Michigan, Ann Arbor, MI 48109-2029

It is quite fitting for a symposium reviewing progress in infant nutrition in the 20th century to start with a review of infant mortality rates during that time period. Indeed, it has been a truism in public health that, within limits, the infant mortality rate of any community, large or small, reflected its general state of health better than any other single indicator. Although no longer valid for the wealthier countries, it is still the norm for most countries in the world, where the diseases that kill most babies, i.e., infections, diarrhea and pneumonia, are all enhanced by inadequate nutrition. Interrelation of infection and nutrition was appreciated early, as documented persuasively in Scrimshaw's classic 1975 review (1).

At the beginning of the 20th century, infant mortality was at such heights that organized attempts to attack it began more or less simultaneously throughout what is now called the developed world. In the forefront was western Europe, a major effort having come from the French, stung by the loss of the Franco-Prussian War in 1870 and the realization that population dynamics favored a newly united Germany. A landmark step in the United States came when more or less isolated efforts in many cities led to organization in 1909 of the American Association for the Study and Prevention of Infant Mortality, instrumental in promoting the White House Conferences on Children and Youth and stimulating the establishment of the Children's Bureau.

Almost 100 years later, decline in infant mortality has occurred worldwide, dramatically in the industrialized nations, less so and unevenly in many population groups in those nations and worldwide.

Sources of data

Community-wide data used to track infant mortality are routinely collected by government for societal reasons other than health, for example, to establish identity, residence and citizenship. Indeed, in many countries, collection of birth and death statistics is a responsibility of the police or a central statistical agency. But those needs require the same high

degree of completeness as that required for vital statistics; thus, the data collected for these purposes are well adapted for analysis in relation to health conditions.

This report will concentrate chiefly on our own country, for which information on the completeness and accuracy of the data is readily available. Some international comparisons will be made later.

In the United States, countrywide information gathering and analysis on population, births and deaths has been the responsibility of a succession of Federal agencies. In 1900, it was the Bureau of the Census in the U.S. Department of Commerce, moving later, in various stages, to its present location in the National Center for Health Statistics (NCHS),² a unit of the Centers for Disease Control, within the U.S. Department of Health and Human Services.

Four "vital events" are recorded and reported on officially, i.e., births, deaths, marriages and divorces. Crucial to the study of infant mortality was acceptance of a uniform definition of a live birth. It was not until 1951, however, that the Fourth World Health Assembly, the governing body of the WHO, adopted a standard definition of a Live Birth, to wit:

A live birth is any product of conception which, after complete expulsion or extraction from its mother, irrespective of the duration of pregnancy, breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born.

The infant mortality rate is a ratio of all deaths in y 1 of life to the total number of live births as defined above. Completeness of birth registration is thus crucial to accuracy. In the United States today, almost all births take place in hospitals, making registration a relatively straightforward routine; early in the century, however, many, if not most, births took place in homes³ and were not officially registered. In those years, a new health officer in a rural area promptly learned that the quickest way to reduce his jurisdiction's infant mortality figures was merely to increase birth registration!

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² Abbreviations used: BRA, Birth Registration Area; HIV, human immunodeficiency virus; NCHS, National Center for Health Statistics; SIDS, sudden infant death syndrome.

³ I was born at home, in Brooklyn, NY, but the physician reported it by signing the form. The handwriting on the certificate, except for the doctor's signature, is my father's.

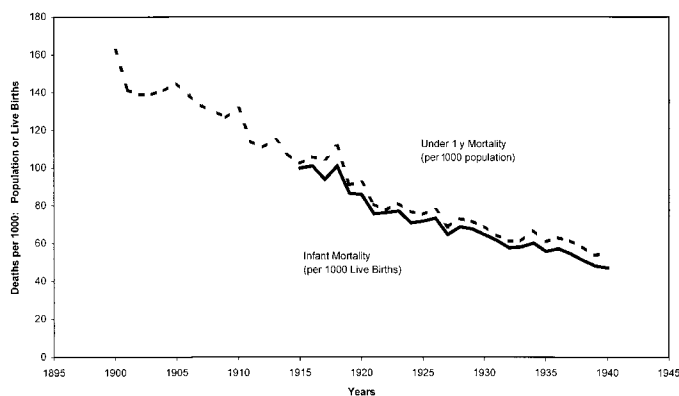


FIGURE 1 Under 1 y mortality, 1900–1940, vs. infant mortality, 1915–1940, USA

The years 1900, 1915 and 1933

In 1900, when the republic's population was 75 million, only a few states and cities had essentially complete birth reporting. It was not until 1915, when the population had reached 100 million, that the Bureau of the Census, for reporting purposes, established a Birth Registration Area (BRA), comprising 10 states and the District of Columbia, all of which regularly registered at least 90% of their live births. Although the BRA involved only one fifth of the then 48 states, it did include 50% of the nation's population. Other states qualified in short order and, by 1933, with admission of Texas to the BRA, the entire country was covered.

Thus, because of the different denominators, we have no representative national infant mortality figures, as such, for the first decade and a half of the century. However, earlier establishment of a Death Registration Area allowed calculation of an age-specific death rate for y 1 of life, approximating the infant mortality rate. This rate is perforce higher than the infant mortality rate per se, because the denominator used for the age-specific rate, the average population <1 y old, has already been diminished by the high mortality of the first few months of life.

The distinction between the two rates is largely academic, as shown in **Figure 1**, a comparison covering the first 40 y of the century. Clearly, a decline in infant deaths was already in progress when the BRA was established. To be consistent, however, this discussion will begin with the establishment of the BRA and deal primarily with the period 1915 to the present.

Age at death

Between 1915 and 1997, there was a dramatic >90% overall decline in mortality in y 1 of life (**Fig. 2**). This graph, like the subsequent ones dealing with time trends, is on a logarithmic scale, to allow direct comparison of speed of change for values of quite different magnitude. **Figure 2** shows four curves on the same scale as follows: 1) y 1 as a whole; 2) the first 24 h; 3) the neonatal period, defined as the first 28 d of life; and 4) the postneonatal period, that is, 1–11 mo, the rest of y 1 of life.

Early on, the major decline was postneonatal. In 1915, deaths between 1 mo and the first birthday constituted some 60% of the y 1 total but declined steadily to roughly one third of the total today. Up until World War II and the dawn of the chemotherapy era, this decline appears more closely related to improvement in the biologic environment, particularly less

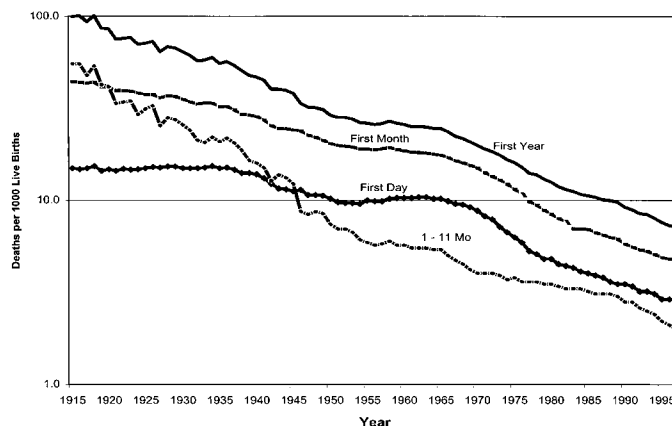


FIGURE 2 Infant mortality, by age at death, 1915–1997, USA

crowded housing and the quality and quantity of water available to households for drinking, personal hygiene and sewage disposal.

Neonatal mortality, ~40% in 1915, declined more slowly up to the late 1960s, but then speeded up, as preventive and therapeutic neonatology made striking advances. In recent decades, that pattern has been repeated for d 1 mortality, coincident with improvements in medical management of the perinatal experience.

Race and ethnicity

Here is the down side of the pattern of decline in infant mortality. Substantial differences continue to exist for certain racial and ethnic groups. To study these and other differences more closely, NCHS has created a special file linking infant death certificates with birth certificates, because the birth certificate contains so much more information about the parents and family (2).

Using data from this file, **Figure 3** compares 1997 rates by race and ethnicity for the standard classifications of the NCHS. Infant mortality is far higher among non-Hispanic African-Americans than for any other racial/ethnic classification.

As shown in **Figure 4**, both Caucasian and African-American rates have declined more or less steadily over the century, but the African-American rate has remained consistently higher than the Caucasian rate. In addition, a distinct differ-

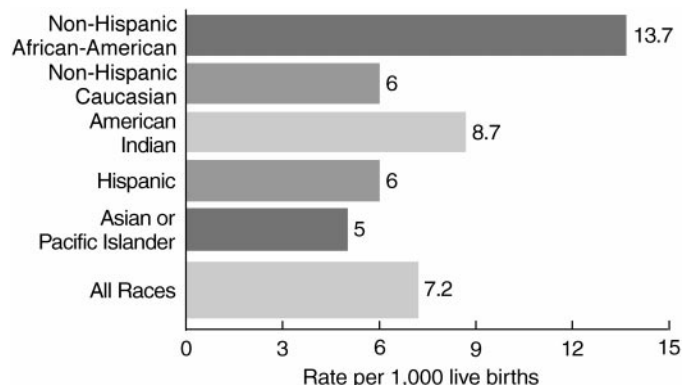


FIGURE 3 Infant mortality, by race and Hispanic origin of mother. Source: Ref. 3.

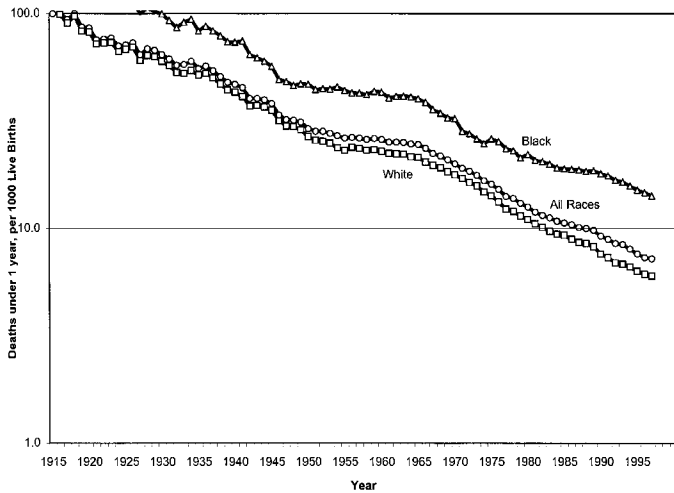


FIGURE 4 Infant mortality, by race, 1915–1997, USA

ence has appeared since ~1970 in the speed of decline in the two rates; the Caucasian rate declined in that period by ~55%, whereas the African-American rate has dropped only 44%. Disturbingly, furthermore, the difference has been growing in recent years.

One problem in studying race and ethnicity as a factor in mortality has been inconsistency in reporting a child's classification on the death and birth certificates. This is not surprising, given the long history of discrimination and the looseness of racial definition, sometimes involving specious quantification of ancestry. Many scientists believe that there is only one human race, and distinctions dependent on skin color or facial characteristics cannot be handled uniformly enough for routine classification of an individual person.

Indeed, there are arguments in favor of discontinuing any separation of data by skin color or any such characteristic. On the other hand, this author is one of those who believe that as long as differences in health status and health services availability are so often associated with prejudicial discrimination, the advantages to keeping records and analyzing data by racial/ethnic groups as accurately as possible, thus permitting assay of unmet needs, outweigh the disadvantages.

Classification of infant deaths by racial and ethnic group has become even more complicated with the growing number of births to couples in which one parent is Caucasian and the other African-American. Because the mother's race is often better correlated with differences in facilities available to the child, NCHS has used the linked birth and death certificate files since 1980 to classify infant death rates by race of mother rather than by race of child. Thus classified, the recent African-American/Caucasian divergence is even larger (3).

African-American/Caucasian differences over the century are also evident when neonatal and postneonatal mortality are examined separately (Figs. 5, 6). In mid-century, there was a period of ~2 decades when the divergence in postneonatal rates grew substantially. Later, the trend in the two rates became more or less parallel again, until the recent increasing divergence. Parity has never been approached.

Birth weight

A critical factor influencing the relationship of race and ethnicity to infant mortality is weight at birth. Consistently, throughout the century, relatively more African-American

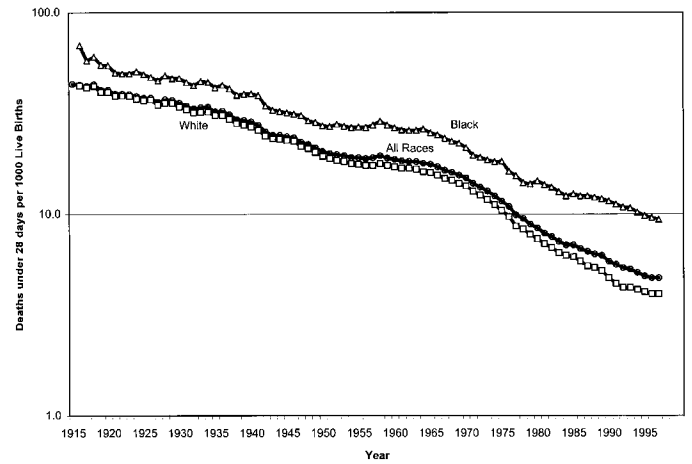


FIGURE 5 Neonatal mortality, by race, 1915–1997, USA

infants in the United States have weighed <2500 g at birth, the accepted dividing line for immaturity. As one example, a comprehensive study of 209,055 births in 1939–1940 in New York City (4), found that 7.3% of Caucasian infants were born weighing <2500 g in contrast to 12.3% of non-Caucasian infants, who consisted almost entirely of African-American infants in those years.

Similarly, in 1997 (5), among almost 4 million live births nationwide, 6.5% of all non-Hispanic Caucasian infants weighed <2500 g at birth vs. 13.1% of non-Hispanic African-American infants and 6.4% of Hispanic infants. Table 1 shows birth weights and mortality rates for the various racial/ethnic groups. The high percentage of non-Hispanic African-American infants born at low birth weight translates into a much higher level of total infant loss because so many more are in the highly vulnerable weight range.

Among all infants within the 1500- to 2499-g weight group, however, the mortality of non-Hispanic African-American infants is lower than that of non-Hispanic Caucasian infants, 15.8 compared with 17.0. This tends to support the thesis that, at a given weight, African-American infants are more mature than their Caucasian counterparts. As far back as the 1930s, supporting evidence for this association was found in the studies of Dunham and her collaborators (6), showing that African-American premature infants experienced earlier de-

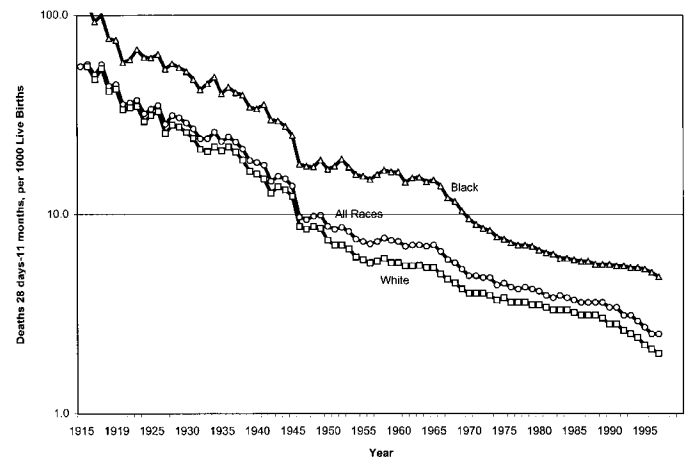


FIGURE 6 Postneonatal mortality, by race, 1915–1997, USA

TABLE 1

Percentage of low and very low birth weight and infant mortality rate, by race and Hispanic origin, USA, 1997

	Birth weight (%)		Deaths per 1000 live births in weight group			
	<1500 g	<2500 g	<2500 g	<1500 g	1500–2499 g	2500+ g
All races	1.4	7.5	7.2	252.8	16.7	2.7
Non-Hispanic Caucasian	1.1	6.5	6.0	240.7	17.0	2.5
Non-Hispanic African-American	3.1	13.1	13.7	268.9	15.8	4.1
Hispanic	1.1	6.4	6.0	250.2	16.9	2.3
American Indian	1.2	6.8	8.7	241.4	25.6	4.6
Asian-Pacific Islander	1.1	7.2	5.0	218.8	13.7	1.9

velopment of wrist bones than did Caucasian infants at the same weight. How to factor in the influence of socioeconomic differences and long-time discrimination is beyond the scope of this paper.

Within the 1500- to 2499-g weight group, the mortality rate for Asian and Pacific Islanders is lowest and American Indians is highest. The same relationship holds for infants born at ≥ 2500 g.

Medical causes of death

Study of causes of death from death certificate data are complicated by the regular decennial revisions of the International Classification of Diseases and Causes of Death,⁴ (7) made necessary by advances in medical knowledge. As each revision has been introduced, NCHS and its predecessors have issued conversion manuals to make it possible to track specific causes over successive revisions. This has been relatively straightforward for major cause groups, but difficulties occur as new causes enter the classification and more of the mechanisms of various diseases are better understood.

Despite these reservations, secure inferences can be drawn about major cause groups. **Figure 7** shows the status of the major causes of infant mortality for representative points in the 20th century, namely, 1912, 1937, 1962, 1987 and 1997.⁵

Most striking is the remarkable decline of deaths from diarrheal diseases in the first half of the century, most of it well before the flowering of the antibiotic era. Two major factors were probably at play, i.e., major environmental improvement, which reduced the spread of various pathogens, and great progress in understanding fluid and electrolyte therapy. In 1930, in fact, the death rate from diarrheal diseases alone, was more than four times the total infant mortality rate from all causes in 1997.

In explaining this change, I am fond of telling what I call my Henry Ford story. I exaggerate, to be sure, but the advent of a motor car so inexpensive as to be accessible to large numbers of the population has never received proper credit for its effect on child health. Specifically, one major effect of introducing an affordable car was to drive horses and their stables out of the cities. And with them went the manure that nourished countless generations of flies.

My great friend, Dr. James Watt, whose early career was in

⁴ By international agreement, all deaths are coded according to this list, which is revised periodically under the leadership of the WHO. These international lists go back to the 17th century but really general use did not take hold until the mid-20th century. The current revision is the 10th, which, although dated 1995, became official for general use in January 1999.

⁵ The first four dates were chosen arbitrarily for another purpose, but they are illustrative of change during the century.

the epidemiology of shigellosis and salmonellosis, thought that perhaps an even more important effect of advent of the cheap motor car era was the \$5 a day wage and the related increase in workers' annual income. Assured employment led to less crowded housing and more opportunity for personal hygiene, essential factors in breaking the chain of transmission.

In another dimension, pediatric understanding of fluid and electrolyte therapy increased so greatly that, by 1937, diarrheal

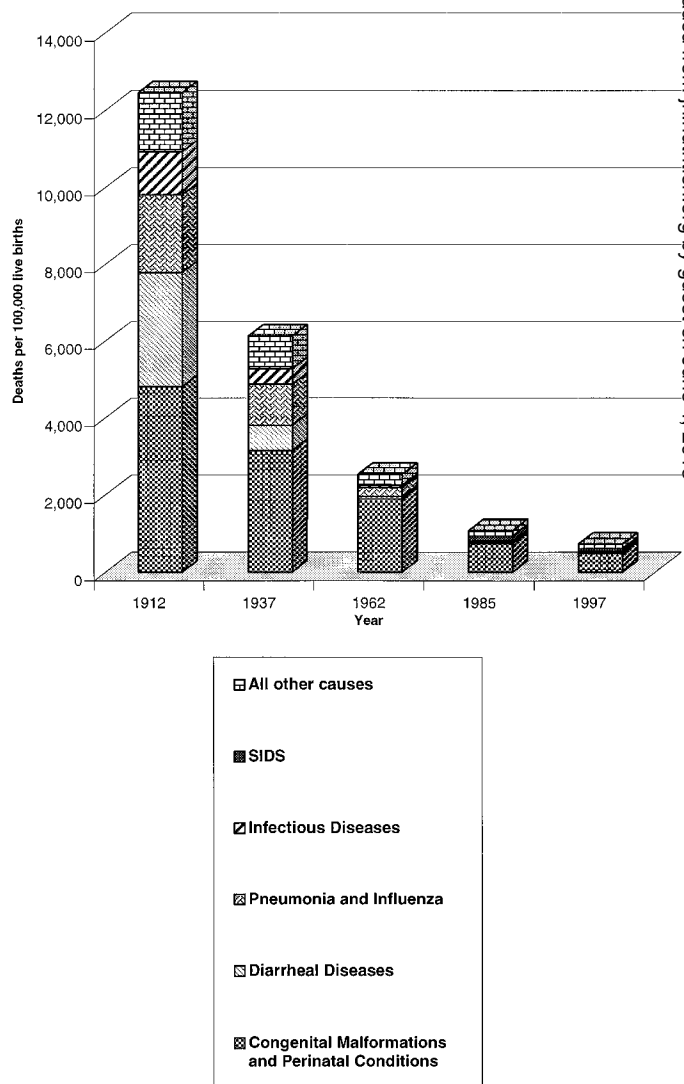


FIGURE 7 Causes of infant mortality, selected years, USA

TABLE 2

Main causes of infant mortality, by race and Hispanic origin, USA, 1997

	Non-Hispanic African-American	Non-Hispanic Caucasian	Hispanic
Congenital anomalies	182.4	151.5	168.2
Short gestation and low birth weight	285.3	65.5	71.0
Sudden infant death syndrome (SIDS)	145.7	70.7	46.5

disease deaths had been reduced to <0.1 of earlier levels. It had become uncommon for a pediatric hospital to lose even a severely dehydrated child. To be sure, the battle is not over; in 1997, there were still 276 deaths in the United States classified as from diarrheal disease, most of which were likely preventable. And it must not be forgotten that these diseases remain an important cause of infant mortality in the developing world.

Deaths from infectious diseases had also diminished strikingly by 1937; yet it was only in that year that use of the sulfonamide drugs became widespread and antibiotics were still several years off. Typhoid fever had almost disappeared and measles deaths had been reduced sharply. It was the rare medical student who had a chance to see a case of diphtheria. In 1997, infant deaths from infectious diseases in total, including HIV, numbered 721, which represents <0.2/1000 live births. Similarly, deaths from pneumonia and influenza, many of which might just as well have been classified as infectious diseases, had also diminished strikingly. Again, diminution in crowded housing had a substantial effect before the antibiotic era, but availability of the latter played a greater role than in the diarrheal diseases.

As infant mortality in total declined, the main causes have changed substantially. Race and ethnicity play a large role, as is evident in **Table 2** and **Figure 8**. Perhaps most notable from the figure is that the death rate from diseases associated with low birth weight and short gestation among non-Hispanic African-American babies is >4 times as high as in either non-Hispanic Caucasian or Hispanic babies. Some of the factors associated with this difference were mentioned earlier in relation to birth weight and growth and development.

On the other hand, the death rate from congenital malformations is of the same order of magnitude for all three groups, the only significant cause of infant death with such similarity. Because this cause of death is closely related to genetic factors, the similarity among the main groups supports the one human race concept.

Sudden infant death syndrome (SIDS) appeared as a significantly separate cause of death only in roughly the last quarter of the 20th century. Unexplained death in infancy has been reported probably as long as records have been kept, but only in recent decades has there been acceptance of it as a specific entity. More recently, recommendations to have babies sleep on their backs have been followed by substantial reduction in reported deaths from SIDS in many of the more developed countries.

To be sure, analysis is significantly affected because SIDS is so often a diagnosis reached by exclusion. Furthermore, it is difficult to explain the much higher SIDS death rate in non-Hispanic African-American babies, over twice the rate in

non-Hispanic Caucasian infants and four times the Hispanic rate. Although in non-Hispanics, both Caucasian and African-American, the SIDS rate is roughly half of what it was two decades ago, the proportion of all causes remains at ~10%.

As the 21st century begins, the developed world faces new threats in infectious diseases, with a combination of resurgent old diseases and emergent new ones. The latter frequently receive more press—there is always special interest in the exotic—but there is good reason to be even more concerned about tuberculosis and syphilis. Resistance of microbial agents to what is now a huge armamentarium of specific agents should be cause for caution in their use and alertness to what looks like a growing problem. Human immunodeficiency virus (HIV) infection is such a menace in all parts of the world and especially serious in some areas that devoting increasing attention to this infection is amply justified.

International comparisons

Justification for comparing U.S. infant mortality rates with other countries rests on two possible premises, that we may gain new knowledge, to our advantage, from those who have done better than the United States, and that we are serious about our responsibility to the principle expressed in the preamble of the WHO Constitution, i.e., “the health of children in any country affects the health and welfare of children in all countries.” We need to seek constantly for ways to help decrease excessive infant mortality elsewhere, to help ourselves as well as others.

Measuring progress in lowering infant mortality against the accomplishment of other countries is made difficult by differences among the nations in vital statistics procedures and rules. Despite the very considerable progress that has been achieved in eliminating these differences, there remain major problems in completeness of reporting, both of births and deaths. Thus, as of now, barely a fourth of the world’s people live in countries in which data are sufficiently complete for acceptance in the United Nations Demographic Yearbook as consistent and reliable. In the other three fourths, with a total population of 4500 million, including some of the world’s largest countries, one has to rely on sampling and informed estimates. Techniques for making such estimates, however, have been improving steadily and one can draw some inferences with reasonable confidence.

For example, Ronald Freedman, one of the world’s leading

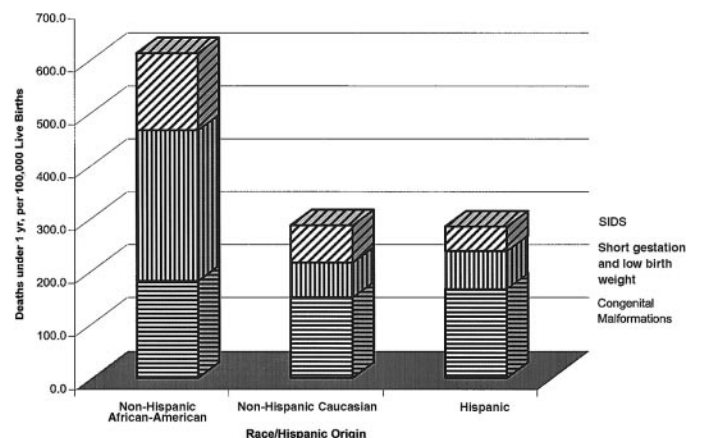


FIGURE 8 Causes of infant mortality, 1996, by race and Hispanic origin, USA

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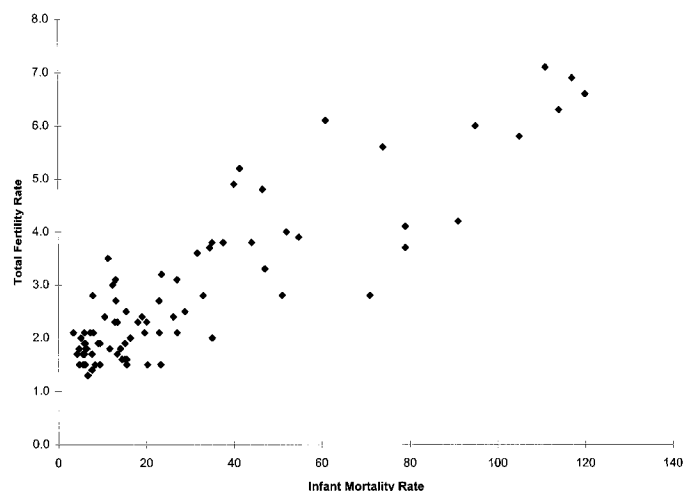


FIGURE 9 Infant mortality rate vs. total fertility rate, 82 countries

demographers, after careful analysis of data available from public and private sources, believes that every country in the world, large or small, rich or poor, has experienced some decline in infant mortality between 1960 and the present day (Freedman, R. A., personal communication). He chose 1960 as the base point because that was the year the world's population reached 3 billion, meaning that today's population of 6 billion represents a doubling of the world's people in only four decades. More specifically, WHO has estimated that the world figure for infant mortality declined from 87 per 1000 live births in 1978 to 57 in 1998.

But this decline still leaves a long way to go; an infant mortality of 57 is ~8 times ours. As of the beginning of 2000, the world is in a period of considerable challenge to the way economy affects development. Demonstrations against the policies of the World Bank and the International Monetary Fund are commonplace. How best to improve development throughout the world is not a discussion I can enter usefully, but the evidence for a relationship between economic development and child health is overwhelming.

There are, however, some health indices closely related to development in any population. One of these is the Total Fertility Rate, a measure of the total number of children a mother will have throughout her reproductive lifetime. In 1960, the world average was estimated to be 4.94. It is predicted that by 2000, that figure will be almost halved, to 2.64, not too far from the level of 2.1, commonly accepted as that needed to maintain a stable population. WHO has estimated that in 1975, almost a fourth of the world's population lived in countries in which the total fertility rate was already 2.1 and predicted that this proportion will have reached three fourths by 2025. Note, however, that the world average is influenced by the very low fertility rates in Europe and eastern Asia, counterbalancing to a considerable extent rates of 5 and 6 in parts of Africa. That this rate has a strong relationship to infant mortality is shown in **Figure 9**, a scatter diagram with total fertility rate on one axis and infant mortality on the other. The closeness of the fit is indicated by an *R*-value of almost 9.

Another major concern in many societies is a high incidence of pregnancy among teen-aged women. **Figure 10**, again a scatter diagram, with infant mortality on one axis and percentage of pregnancies among mothers <20 y old on the other, shows no clear relationship. There are, of course, many

reasons besides infant mortality for considering teen-aged pregnancy undesirable.

Although the prospect of lower fertility rates gives hope for a more stable world population, there are still several millions of preventable deaths among the world's children. **Figure 11**, dealing with all deaths under 5 y of age rather than just infants, shows an approximation of the causes in the developing countries. WHO attributes 7 out of 10 childhood deaths in developing countries to just five main causes, or a combination of them, namely, pneumonia, diarrhea, measles, malaria and malnutrition, the latter clearly affecting all the others. And all of them are susceptible to a preventive attack.

WHO has successfully led the campaign to eradicate smallpox and appears to be well on the way to eradicating poliomyelitis. No one speaks of eradicating diarrheal diseases or pneumonia, but some of the techniques that have proved successful in eradicating specific infectious diseases could surely be used effectively to decrease disease levels of the much more common afflictions cited above.

Turning now to the other side of the picture, what can we learn from those countries with lower rates than the United States? In many other developed countries, decline in infant mortality during the 20th century has been even more extraordinary than in the United States. In 1949, when I first began publishing a vital statistics summary in the journal *Pediatrics*, the infant mortality rate in the United States was 31; only 5 countries, all much smaller, had lower rates. In subsequent decades, however, as rates improved generally, the U.S. rate declined more slowly than that of a number of other countries so that it is currently tied for 23rd among countries with a population of at least 2.5 million.

International comparisons are affected to some extent by questions of local practice, such as the rigor with which the distinction between a live born and stillborn infant is applied. Colleagues have told me of instances in delivery rooms in Japan, as one example, of seeing a newborn called a stillbirth that would surely have been considered live born in the United States. The significance of such observations is difficult to evaluate. On the one hand, calling live births stillbirths should raise the fetal mortality rate disproportionately, yet Japan's fetal mortality rate has long been lower than that of the United States. Furthermore, the Japanese infant mortality rate has declined more rapidly than that of the United States for many years, as shown in **Figure 12**, and there seems no

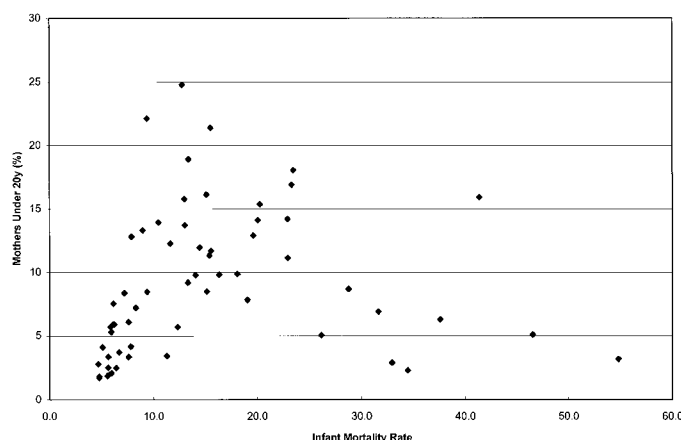


FIGURE 10 Infant mortality rate vs. percentage of mothers <20 y old, 82 countries

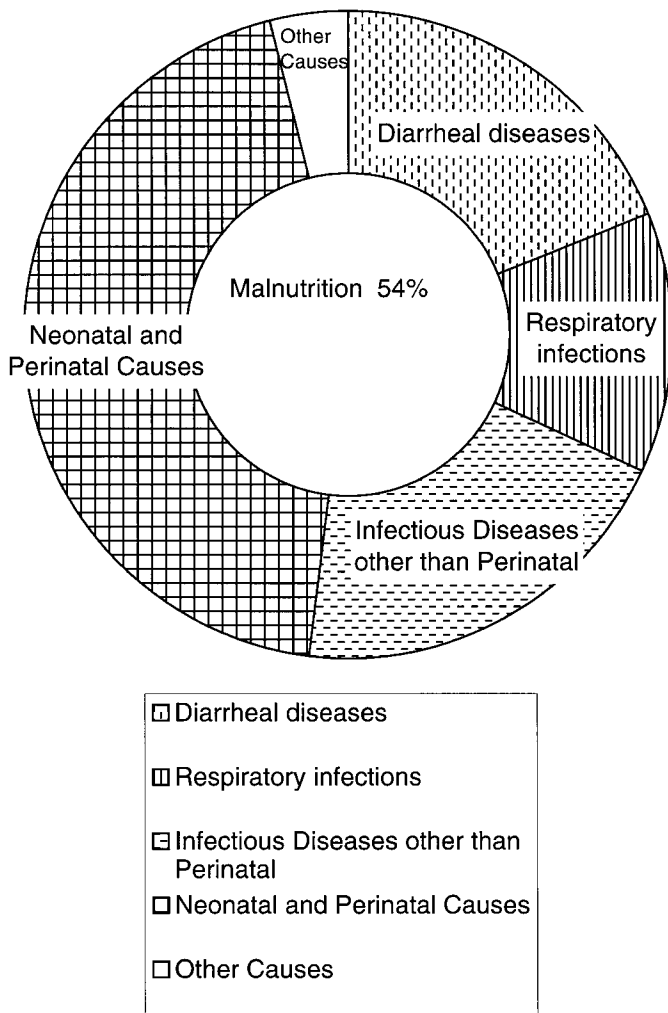


FIGURE 11 Major causes of mortality in children <5 y old, developing countries

reason for diagnostic and classification procedures to change from year to year.

In addition to Japan, Figure 12 compares trends in infant mortality rates in the United States with three other countries. In 1930, Japan's rate was well over 100 but since then has declined more rapidly than any of the others to the point at which, in 1997, Japan had the lowest rate in the world, reported in that year as 3.7. The United Kingdom and Canada are included because of general similarity in culture and outlook. Early in the century, their rates were higher than those of the United States, but they have been lower since the mid-1960s.

The fifth country, Cuba, is rather a special case. Complete birth and death data are available for Cuba only since the mid-1970s because serious attempts to make vital statistics reliable began only after Castro seized power and put a high priority on health and health services. Despite the U.S. embargo and the dire straits of the Cuban economy, its infant mortality rate has declined steadily and the last rate reported, for 1997, was 7.2, the same as the United States. As this paper was being readied for press, the Cuban rate for 1998 was reported as 6.4, well below the U.S. figure of 7.0 for that year.

Two other Latin American rates may be compared with

Cuba. Chile, which has long prided itself, justifiably, on the excellence of its vital statistics system, had a rapid decline in infant mortality beginning in the 1960s and 1970s; in recent years, however, the Cuban decline has been faster. The Chilean rate in 1997 was 10.5 compared with 21.9 in 1983.

Puerto Rico, a commonwealth under U.S. jurisdiction, has many geographic and racial similarities to Cuba. In 1983 and through most of the rest of the 1980s, the Puerto Rican infant mortality rate was very similar to that of Cuba but the latter began to decline more rapidly about 1989 and, in 1997, was roughly one third less than the Puerto Rican rate.

In a society as large and complex as the United States, question is always raised concerning the true importance of small international differences when rates are so low. Furthermore, a great deal depends on how much a given society wishes to invest in the sometimes very large resources needed to save tiny neonates. On the other hand, the reasons behind a significant proportion of infant deaths are related to differences in care rooted in socioeconomic distinctions. Lack of adequate social support mechanisms and insufficient health care availability hit particularly at the very segments of society that experience substantially higher infant mortality rates. Although such rates no longer reflect so directly the health status of the whole society, they affect disproportionately some racial and ethnic groups. It is still relevant that, of the countries in the world with infant mortality rates <10/1000 live births, the United States is the only one without some form of universal health care coverage.

SUMMARY

Infant mortality has declined in dramatic fashion in our country throughout the 20th century; although all have benefited to some extent, the decline has not been even among the various segments of society. Of the racial and ethnic groupings recorded by the NCHS, non-Hispanic African-Americans have shown least improvement and Asian and Pacific Islanders the most. Causes of infant mortality are drastically different from those prevalent early in the century, which were closely connected with living conditions and the environment. The current leading causes are more amenable to medical technology; those for Caucasians include congenital malformations, disorders related to short gestation and low birth weight, and SIDS, whereas for African-Americans, short gestation and low birth weight lead by a wide margin. SIDS, although quantitatively half of what it was two

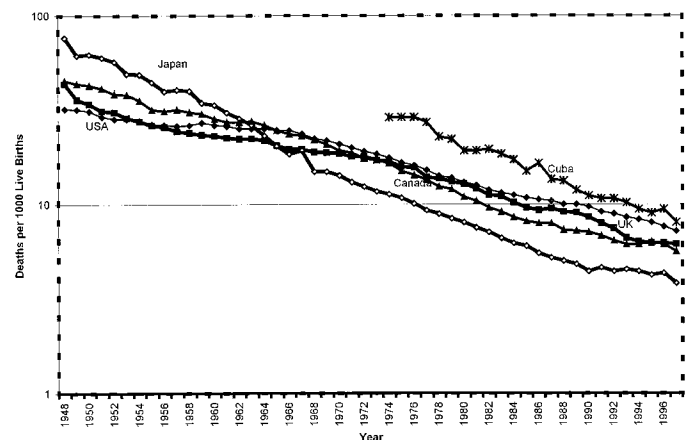


FIGURE 12 Infant mortality, 1948-1997, selected countries

decades ago, is still at 10% of all causes for both Caucasians and African-Americans; it is less prominent among Hispanics. Internationally, three fourths of the world's population live in countries in which records are too incomplete to permit detailed analysis. Nevertheless, estimates of the world's total fertility rate, closely related to infant mortality, suggest that it has halved in the last four decades. WHO attributes 7 out of 10 childhood deaths in developing countries to just five main causes, or a combination of them, i.e., pneumonia, diarrhea, measles, malaria and malnutrition, causes of death of very low incidence in the United States. Throughout most of the century, infant mortality in the United States has declined more slowly than in many other countries, moving from 6th on the list to a current 23rd. The United States is the only one of the developed countries without some form of universal health coverage.

LITERATURE CITED

1. Scrimshaw, N. S. (1975) Nutrition and Infection, *Progress in Food and Nutrition Science*, vol. 1, pp. 393-420.
2. Hoyert, D. L. (1994) Effect on mortality rates of the 1989 changes in tabulating race, *National Center for Health Statistics. Vital Health Stat.* 20: 25: 1-25.
3. National Center for Health Statistics (1999) Deaths: Final Data for 1997, *National Vital Statistics Reports*, vol. 47, no 1. NCHS, Hyattsville, MD.
4. Baumgartner, L., Pessin, V., Wegman, M. E. & Parker, S. L. (1990) Weight in relation to fetal and newborn mortality; influence of sex and color. *Pediatrics* 6: 329-342.
5. Ventura, S. J., Martin, J. A., Curtin, S. C. & Mathews, T. J. (1999) Births: Final Data for 1997. *National Vital Statistics Reports*, vol. 47, no. 18. National Center for Health Statistics, Hyattsville, MD.
6. Dunham, E. C., Jenss, R. M. & Christie, A. U. (1939) Consideration of weight and sex in relation to growth and development of infants, *J. Pediatr.* 14: 156-168.
7. World Health Organization (1995) *International Classification of Diseases, Injuries and Causes of Death*, 10th rev. WHO, Geneva, Switzerland.