



# Measurement of Infant Mortality in Less Developed Countries

International Research  
Document No.5



U.S. DEPARTMENT OF  
COMMERCE  
Bureau of the Census

Prepared under a resources support services agreement with the  
U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT  
Development Support Bureau

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**Measurement of  
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Countries**

by  
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Issued August 1978



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**ACKNOWLEDGMENTS**

International Research Document No. 5 was prepared in the Population Division under the general direction of Samuel Baum, Assistant Chief for International Demographic Statistics, and under the supervision of Sylvia D. Quick, Acting Chief, International Data Evaluation Branch.

This paper was prepared for the Bureau for Program and Policy Coordination of the U.S. Agency for International Development, under a Resources Support Services Agreement with the Development Support Bureau.

The authors wish to extend sincere appreciation to fellow staff members at the International Demographic Data Center, Population Division, who provided most of the data sources and reviewed drafts of the paper. Special thanks are extended to their colleagues at the International Statistical Programs Center and the Population Division of the U.S. Bureau of the Census, the East-West Population Institute, the Epidemiological Studies Branch of the Food and Drug Administration, the International Program of Laboratories for Population Statistics of the University of North Carolina, the National Center for Health Statistics, the Pan American Health Organization, the Population Council, the United Nations Population Division and Statistical Office, the United Nations Research Institute for Social Development, the U.S. Agency for International Development, the World Fertility Survey, and the World Health Organization for their valuable suggestions

during the preparation of this paper. Finally, special gratitude is due to **Donna M. Coppage**, **Martha A. Greene**, and **Patricia A. Kirkpatrick** for typing the various drafts, and to the clerical staff, **Claire R. Dewberry**, **John R. Gibson**, and **Mary S. Malachi**, for their assistance in preparing the tables.

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**Library of Congress Cataloging in Publication Data**

Heligman, Larry.

Measurement of infant mortality in less developed countries.

(International research document ; no. 5)

1. Infants—Mortality—Statistical methods.
  2. Underdeveloped areas—Statistics, Vital. I. Finch, Glenda, joint author. II. Kramer, Roger, joint author. III. United States. Bureau of the Census. IV. Title. V. Series.
- HA42.I57a no. 5 [HB1323.I4] 301.32'08s 78-606089  
[001.4'224]

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GPO Stock No. 003-024-01561-7

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## INTRODUCTION

How well a population protects the newborn infant against the high mortality risks of the first year of life depends upon the social, economic, and physical well-being of that population. As a result, levels and trends of infant mortality are sensitive indicators of a nation's social and economic development. In recognition of this fact, the U.S. Foreign Assistance Act was amended in December 1975 to include the reduction of infant mortality as one of five development criteria to be considered for assessing the commitment and progress of less developed countries (LDC's) in meeting development objectives.<sup>1</sup>

However, levels and trends of infant mortality can be used as a development criterion only when the necessary data of adequate quality are available. This paper examines the feasibility of measuring and reporting on the levels and trends in infant mortality in 52 developing countries selected by the Agency for International Development (see appendix table A-1). It reviews the different approaches for estimating infant mortality in developing countries; the availability, timeliness, and quality of the necessary data in the 52 selected countries; and the feasibility of regularly measuring and reporting on infant mortality change in these countries.<sup>2</sup>

This paper was prepared at the request of the Bureau for Program and Policy Coordination of the Agency for International Development (AID) by the U.S. Bureau of the Census, under a Resources Support Services Agreement with the Agency for International Development.

## SOURCES OF DATA AND PROCEDURES FOR ESTIMATING LEVELS AND TRENDS OF INFANT MORTALITY

Infant mortality rates (IMR's) are calculated as the ratio of deaths of infants under 1 year of age in a calendar year to the number of live births in the same year.<sup>3</sup> This is the method for calculating the IMR's no matter what the source of data—vital registration system, sample survey, or census. Although the method of calculating an IMR is the same for all sources of data, the method of determining the components of the IMR—births, and deaths under 1 year of age—does differ among the sources.

Vital registration systems are usually legislatively or administratively mandated systems in which all births and deaths must be reported to designated registration offices. The data are collected at local levels and forwarded to national offices for collation and tabulation.

Sample survey data are collected through the visits of trained interviewers to representative samples of households in a population. Information on the occurrence of births and infant

<sup>1</sup> The other four criteria are increase in agricultural productivity, control of population growth, equalization of income distribution, and reduction in unemployment and underemployment.

<sup>2</sup> Child mortality, which is defined as mortality among those aged 1 through 4, is not considered in this paper since both its determinants and its measurement problems differ from those of infant mortality. For a discussion of these issues see Benjamin and Haycocks (1970, pp. 5-6).

<sup>3</sup> Technically when calculating infant mortality rates, an adjustment should be made to account for the fact that some of the infant deaths in the given year occurred to births of the preceding year. However, bias introduced for this reason will be small unless the number of births or infant deaths is changing rapidly. For more information see Logan (1953).

deaths is collected retrospectively (i.e., for each eligible woman, questions are asked to determine how many births and how many infant deaths have occurred during the past years), or by followup (i.e., followup visits to each household asking whether any birth has occurred in the household during the time between visits, and whether anyone who was in the household at the time of the last visit, or was born since the last visit, had died). Simultaneously with a survey, a second system of data collection, such as sample registration, may be ongoing and results of the two systems can be matched on a case-by-case basis to form a dual system estimate. Surveys may be either ad hoc and take place for only a finite period, or ongoing continuous and be designed as permanent household surveys, such as the Monthly Current Population Survey in the United States.

Censuses can also be used to collect statistics on births and infant deaths by asking the retrospective questions described above.

In addition to these procedures for directly deriving the IMR from births and infant deaths, indirect methods have been developed for estimating infant mortality. These indirect estimates may be derived from data on children ever born and children surviving, as reported in surveys or censuses; from analysis of the age distribution of a population, as reported in one or more surveys or censuses; or from analysis of the age distribution or cause of death distribution of infant deaths from vital registration systems.

The advantages and drawbacks of each of these sources of data are discussed in detail below.

### Vital Registration

The United Nations defines civil registration as the "continuous, permanent, compulsory recording of the occurrence and characteristics of vital events" (United Nations, 1973, p. 156). Such a system would appear to be the ideal mechanism for the collection, tabulation, and publication of an annual series of infant mortality rates. In fact, in those countries with high quality systems, vital registration is the best source for describing levels and trends in infant mortality on a timely basis. Nevertheless, there are numerous problems that severely limit the use of vital registration data in the developing world. Although almost all countries considered in this paper have passed legislation enabling the compulsory registration of vital events, only half publish vital registration data and less than one-fourth have data of sufficient quality to be used for estimating infant mortality. If so many countries have enabling legislation and almost half of the countries publish results, why are the data of such poor quality as to be unusable in all but a few countries? The reasons stem from problems in both the collection and the tabulation of data.

**Problems of omissions.** The most serious problem is omissions. Although registration of vital events may be compulsory, the law is not enforced in many countries. Built-in disincentives or other deterrents such as the long distance to a registrar, fees, and superstition cause people to be reluctant to register events voluntarily. Underregistration of births and infant deaths is common in the majority of countries in the developing world and is often obvious from the implied levels of infant mortality rates. For example, according to a recent survey in Honduras the IMR for the period 1970-72 is in excess of 100 infant deaths per 1,000 live births (Centro Latinoamericano de Demografía,

1975). However, the registered infant mortality rates between 1970 and 1972 are much lower:<sup>4</sup>

1970	1971	1972
33	40	39

In some cases, though, reasonable IMR's can be obtained from vital registration systems despite problems of very large under-registration. This happens when birth registration is about as incomplete as death registration. For example, in the Philippines the IMR's from the vital registration system between 1965 and 1973 are:

1965	1966	1967	1968	1969	1970	1971	1972	1973
73	72	72	71	67	60	62	68	74

These rates are within a reasonable range of infant mortality for a country at the level of economic and social development of the Philippines [the Philippine IMR for 1970 has been estimated as about 80 per 1,000 (Engarcia, 1974)]. Hence, even though the calculated IMR's appear reasonable, it cannot be assumed that registration is complete and therefore reliable. In this case, the very low registered crude birth rate (around 25 per 1,000) indicates a probably low level of completeness of birth registration and hence casts doubt on the reliability of infant death registration and on the calculated IMR. The implied IMR for the Philippines is accurate only if, by chance, the under-registration of births and infant deaths is the same. Therefore, in order to accurately estimate IMR's from vital registration data, independent estimates of underregistration of both births and infant deaths are necessary.

If the degree of omission of births and infant deaths remains constant over time, the implied trend of the calculated infant mortality rates would be correct even though the level is wrong. For example, in Egypt between 1965 and 1970 the registered IMR's are:

1965	1966	1967	1968	1969	1970
113	127	116	131	119	116

Although the levels of IMR stated here are about 15 percent too low (Valaoras, 1972), the roughly constant trend is acceptable because the levels of omission are thought to be more or less constant. Nevertheless, it is uncertain whether the higher rates in 1966 and 1968 are due to actual higher mortality in those years or due to fluctuations in the completeness of birth and infant death registration.

In Guatemala, the level of omissions in registration data has not been constant. Infant death registration improved from about 80 percent complete in 1965 to nearly 100 percent complete in 1970, while birth registration was nearly 100 percent complete during the entire period (U.S. Bureau of the Census, 1977b). Unadjusted and adjusted IMR's for Guatemala between 1965 and 1970 are as follows:

	1965	1966	1967	1968	1969	1970
Unadjusted . . . . .	93	90	89	92	91	87
Adjusted . . . . .	116	107	101	100	95	87

<sup>4</sup> Unless otherwise noted, all vital event data presented in this paper are from United Nations (1975a). All rates are given per 1,000 live births.

The unadjusted civil registration data suggest that little change in infant mortality occurred during the period whereas the adjusted rates indicate that a sharp mortality decline occurred.

Omissions and lack of knowledge of the level of omission present the most serious problems in estimating infant mortality from civil registration data, but problems of definition and method of tabulation can also be troublesome (United Nations, 1975, pp. 41-42).

**Problem of definition.** The World Health Organization recommends that a live birth be defined as "the complete expulsion or extraction from its mother or a product of conception which . . . breathes or shows any other evidence of life" and that "all live-born infants should be registered and counted as such irrespective of gestational age or whether alive or dead at time of registration, and if they die at any time following birth they should also be registered and counted as deaths" (United Nations, 1973, p. 12).

Unfortunately some countries either use different definitions or do not correctly apply the definition in practice and as a result fail to register births and infant deaths when either the infant dies before the birth is registered or the infant fails to live a certain length of time. Therefore infants that die within the first weeks of life are often excluded from both the birth and death registers. The extent of this problem is illustrated by the many countries considered in this paper which show a death rate for infants under 1 day of age and under 1 week of age lower than that in the United States, a country with considerably lower mortality (see appendix table A-4).

**Problem of tabulation.** The World Health Organization recommends that civil registration data on births and infant deaths be tabulated and published according to date of occurrence of the event rather than the date of registration. According to the United Nations (1975a, p. 42),

Perhaps the most important and widespread limitation on comparability results from compiling statistics of infant deaths and live births by date of registration rather than date of occurrence of the events. Where these procedures obtain a large increase, for whatever reason, in the number of live births registered in any one year, sizable errors may be introduced into the registered infant mortality rates, especially since deaths tend to be more promptly reported than births.

If the delay in registration remains nearly constant and is approximately the same for births and deaths, the rates are not affected to any appreciable degree. But if—as is the case in many countries or areas—a large proportion of the births are not registered until many years after occurrence, then infant mortality rates obtained by relating infant deaths for any one year to births which occurred over a period of years, have little validity.

Among the countries considered here with national registration systems, vital registration data appear to be tabulated by date of registration in the majority of cases.

Births and infant deaths that occurred in the past may be registered in large numbers in a given year because of temporary or sporadic national efforts to improve registration or for other reasons. As a result, large fluctuations in registered births and

registered deaths may occur. A good example where this may be happening is the Dominican Republic:

	1970	1971	1972	1973
Registered Births . . . . .	163,045	162,215	177,163	207,387
Registered Infant Deaths . . . .	8,171	7,912	8,721	8,010
Infant Mortality Rate . . . . .	50	49	49	39

Doubts must be expressed on this apparent trend in the infant mortality rate given the sudden increase in registered births and infant deaths in 1972 and the continued increase in registered births in 1973, while at the same time there was a return to the past level of infant deaths.

Although it was stated previously that registration data of high quality are the best source of timely information on infant mortality, it is necessary to emphasize that levels and trends cannot be accepted on the basis of 1 or 2 years' experience. Because of random annual fluctuations in fertility and mortality behavior, and because of special occurrences (such as an influenza epidemic) in a given year, the IMR's may rise and fall without evidence of any change in the long-run trend of infant mortality rates. Evidence of these types of fluctuations is found in all the examples presented in this section.

### Surveys and Censuses

As stated previously, a high quality vital registration system is the best source for the collection, tabulation, and publication of an annual series of infant mortality rates. However, vital registration data are of high enough quality to serve this purpose in only a few LDC's. The majority of LDC's must turn to special questions in surveys and censuses to provide infant mortality estimates. In addition, many countries use surveys and censuses as a check on the quality of their civil registration systems and to estimate levels of underregistration.

For estimating trends and levels of infant mortality, the most desirable type of survey would be one that is continuous and ongoing—a permanent survey system which, through constancy of staff, methods, tabulation procedures, and analysis provides a continuing and consistent series of infant mortality estimates.<sup>5</sup> These continuous surveys can be of two types—demographic surveys (such as in India) whose primary purpose is the estimation of a time series of vital rates, or multipurpose surveys (such as Lesotho) in which questions for estimating vital events are only a small portion of the survey, often included with questions on labor force, consumer expenditures, literacy, and so forth.

Unfortunately, among the countries considered here, only India and Lesotho gather and publish data on infant mortality from continuous surveys.<sup>6</sup> All other surveys have been of an ad hoc nature, taking place over a finite period, usually less than 3 years. Such surveys, which may be adequate for estimating the levels of infant mortality at the date of the survey, generally provide little information on the trend of IMR's. Even in those

<sup>5</sup> As with vital registration, estimates of infant mortality from continuous surveys may rise and fall annually solely because of random fluctuations or special 1-year occurrences without indicating a changing mortality trend. In fact, because of sampling error these fluctuations may be larger in continuous surveys than in vital registration systems.

<sup>6</sup> A continuous survey with questions relevant to infant mortality is also ongoing in Brazil, but results have never been published. Other countries also have continuous surveys but do not ask questions relevant to infant mortality.

countries in which several surveys or censuses have been taken, the results are often not comparable owing to changes in types of questions asked, the way the questions are asked, quality of samples and enumerations, or differences in tabulations and types of analysis. For example, both the Population Growth Estimation Experiment (Pakistan Institute of Development Economics, 1971) and the National Impact Survey (Pakistan Population Council, n.d.) provided IMR estimates for Pakistan for the 1962-65 period. The former resulted in an IMR of 136; the latter, 117.

Birth and infant death data in surveys or censuses can be obtained through three approaches:

1. retrospective questions in a single or multiround survey in which questions are asked concerning births and infant deaths occurring during a specified period in the past;
2. followup questions in a multiround survey in which repeated visits are made to the same households in order to determine the births and deaths that occurred during the intervals between visits; or
3. the combination of one of the above approaches with some form of continuous recording system and the case-by-case matching of the results of each of these systems to form a dual system estimate.

In general, estimates from dual systems give more accurate results than estimates from followup questions; and estimates from followup questions give more accurate results than those from retrospective questions. Nevertheless, because of differences in ease of carrying out the surveys, timeliness of results, and costs, different types of survey questions may best meet the needs of different countries (United Nations, 1971, p. 8).

Regardless of the approach used, all surveys are subject to sampling error; i.e., the amount of error that can be expected because the estimated infant mortality rate is based on a sample survey rather than on a complete census count. As shown in table A, sampling error is inversely related to sample size.<sup>7</sup>

Hence, except in surveys of very large sample size there will be considerable imprecision in the IMR estimate. In addition, because of sampling error, the trend of infant mortality derived from the results of two or more surveys or censuses may not be statistically significant.<sup>8</sup>

In addition to sampling error, surveys or censuses may be subject to intentional concealment of deaths by the respond-

<sup>7</sup> The sampling errors presented in table A are based on the assumption that a simple random sample of persons is drawn from a given population. In most surveys in LDC's, however, more efficient sampling designs (e.g., cluster sampling or stratified sampling) are used. As a result, the sampling errors in actual practice may differ from those shown. For more information see Economic Commission for Africa (1974, pp. 113-139).

<sup>8</sup> Although small samples generally have large sampling error, it may be easier in small samples to keep measurement error to a minimum. Measurement error includes errors in preparing the survey (e.g., problems in selecting the sample), errors in collecting the data (e.g., the failure of respondents to report vital events to the interviewer), and errors in processing the data (e.g., mistakes in transferring the recorded responses from the questionnaire to the computer punch card or from the computer printout to the publication). For a discussion of measurement error and the relationship between sampling error and measurement error, see Economic Commission for Africa (1974, pp. 93-139), Seltzer (1973), and U.S. Bureau of the Census (1975, pp. 674-678).

ent. This reluctance to disclose an infant death to the interviewer may be due to a variety of reasons, including superstition or fear of legal consequences if the death had not been registered with the proper authorities. Madigan, et al. (1976), using a recently devised technique known as "randomized response," tested for intentional concealment of deaths in the dual system household surveys undertaken in Misamis Oriental Province, Philippines in 1971. Their study found that over 50 percent of all deaths (including deaths over age 1) were purposely concealed from the interviewer.

In all surveys and censuses it is necessary to evaluate the quality of the data collected in order to estimate, if possible, the degree of undercount or overcount. Such an evaluation would include several procedures, including comparison with a post enumeration survey, internal consistency checks, comparisons between the data collected in two or more surveys or censuses, comparisons with estimates available from vital registration systems, and plausibility of the data based upon known demographic relationships. Based upon these types of analyses, the collected infant mortality data must be accepted, rejected, or adjusted.

**Table A. Examples of the Sampling Errors Associated With Estimates of the Infant Mortality Rate, by Size of Sample**

(Sampling errors are shown as the 95-percent confidence interval around an assumed infant mortality rate (IMR) of 100 per 1,000 live births)

Size of sample (persons) <sup>1</sup>	Births in sample	Confidence interval <sup>2</sup>
1,000.....	40	5-195
3,000.....	120	45-155
5,000.....	200	58-142
10,000.....	400	70-130
50,000.....	2,000	87-113
100,000.....	4,000	91-109
500,000.....	20,000	96-104

<sup>1</sup>Assuming a simple random sample of persons from a very large population, a crude birth rate of 40 per 1,000 in every sample (i.e., the crude birth rate has no sampling error), and assuming that infant deaths follow a binomial distribution.

<sup>2</sup>A 95 percent confidence interval indicates that the estimated IMR will fall within the indicated interval in about 95 percent of all samples of the given sample size. The interval is expressed in terms of rate per 1,000 births.

**Retrospective questions.** Because of their low costs, simplicity of execution, and timeliness of results, retrospective questions are the most commonly used survey questions for estimating infant mortality (Lunde, 1976, p. 5). These are the only types of questions that can be asked in censuses. Retrospective questions determine how many births have occurred in each household in the last  $\eta$  (usually 12 or 24) months and how many deaths of infants under age one have occurred in the household during the same period. The results from this approach have rarely been reliable, and have usually given estimates of the IMR that were far too low since infant

deaths are not usually enumerated as well as births.<sup>9</sup> There are many reasons for these consistently low results, including such problems as recall lapse and taboos about mentioning death (United Nations, 1971, p. 9).

This approach was used in Ghana in both the 1960 Post Enumeration Survey (Ghana, 1971) and the 1968 National Demographic Sample Survey (Gaisie, 1973). The enumerated results from these surveys yielded IMR's which were apparently too low: an IMR of 126 per 1,000 in 1960 and 76 per 1,000 in 1968. However, the actual levels of the IMR in Ghana are estimated as about 155 in 1960 and 115 in 1970 (U.S. Bureau of the Census, 1977a). On the other hand, retrospective questions were used in El Salvador and there the results appear to give accurate estimates. Questions on infant deaths in the last 12 months yielded 31 percent more deaths than were found in the registration system and the results of these questions have been used to adjust the civil registration system data for incompleteness (Morris, 1975).

Unfortunately, there is often no clear cut way to check the validity of the results, and values are sometimes accepted only because they are not suspiciously low or high for a country's level of social and economic development. In the 1965-66 Health Survey in Nepal, questions were asked on births and infant deaths during the previous 3 years, along with the date of the event (Worth and Shah, 1969). The results were tabulated according to different time periods:

Infant mortality rate 12 months prior	145
Infant mortality rate 12 to 24 months prior	174
Infant mortality rate 24 to 36 months prior	130

The estimated IMR's range between 130 and 174. Little is known about infant mortality in Nepal and both extremes may be equally plausible although they describe wide differences in mortality.

**Followup questions.** Given the problems with retrospective questions, it is not surprising that other approaches for obtaining vital rates have been tried. One common method is the followup question in multiple round surveys. During the first round, individual records are completed for every member of the household, preferably also determining the pregnancy status of all married women. In subsequent rounds, usually 3 to 6 months apart, the interviewer returns to each household and reviews the status of all household members, i.e., did they migrate from household, die, or remain; was there a change in pregnancy status; were there any live births in the household (asked generally of all women, and specifically of those who were designated pregnant in the previous round); what was the outcome of the live birth, is the new baby a new "entry" or did he/she die; and are there any new migrants into the household? Through a series of followup surveys, live births and infant deaths during each round can be determined, the results of the successive rounds can be summed up when a year's experience has been reached, and infant mortality rates can be calculated.

Although these followup type questions have been shown to work better than retrospective questions, they are not without problems. High among these are costs and the necessity of strict supervision since it is very easy for interviewers to "cheat" (United Nations, 1971, p. 10). There is also a special problem that has often made infant mortality rates obtained from these

<sup>9</sup> Nevertheless, in the 1960 Housing Census of Pakistan, unusually high infant mortality rates were recorded presumably due to better enumeration of infant deaths than of births (Pakistan, 1963).

surveys of poorer quality than overall birth and death rates—that is, the difficulty of learning about the event when an infant is born and dies between rounds. Nevertheless, followup surveys with closely spaced interviews appear to catch more infant deaths than do retrospective surveys. A good example of the difficulties in followup surveys is found in the 1965-66 Nigerian Rural Demographic Sample Survey. Considerable analysis of the data and acceptance and rejection of sample units were necessary before adequate results were available (Nigeria, 1968, pp. 3-4).

**Dual system.** In some countries, one of the above types of questions are combined with some form of registration or continuous recording system in order to provide dual system estimates of vital rates. This approach usually involves a case-by-case matching of the events as reported by each system. The results of the matching provide the number of events caught by both systems, the extent of coverage of each system, and under some conditions an estimate of the number of events missed by both systems [see Marks, Seltzer and Krótki (1974) for further details]. The dual system has the potential to provide the most reliable estimates of infant mortality, especially when the continuous recording system is combined with followup survey questions. But the system does have drawbacks. The matching procedure is very difficult and to some extent the total number of births and infant deaths derived depends upon the matching rules used. The more stringent the matching rules, the more nonmatches there will be, and hence the more "unique" events counted. There is also a problem with "out of scope" events—that is, events which are counted but should not be because they occurred outside of the geographical area or not during the reference period. The inclusion of the "out of scope" events will bias the results upward (Seltzer and Adlakha, 1974). In addition, if an unbiased statistical estimate of the number of events missed by both systems is to be obtained, the two systems must be completely independent. This independence is usually difficult to attain in practice. Nevertheless, in carefully conducted dual systems, the estimate of the number of events missed by both systems is usually quite small and thus of only marginal importance (Economic Commission for Africa, 1974, p. 221). As a result of these problems the dual system, especially when conducted on a national level, is costly, time-consuming, and needs a large staff of qualified personnel both in the field and at the home office.

#### Indirect Estimates

Since the early 1960's many countries have been asking special retrospective questions on children ever born and children surviving, instead of or in addition to survey questions which directly solicit the number of births and infant deaths. William Brass has shown that the resulting tabulations on the average number of children ever born and children surviving by age of woman provide an indirect estimate of the probabilities of a birth surviving to ages 1, 2, 3, 5, and 10. Specifically, Brass has shown that by application of a set of multipliers, the proportion of children who have died among women age 15-19 can be converted into the infant mortality rate, the proportion of children dead among women 20-24 can be converted into the probability of dying before age 2, the proportion of children dead among women aged 25-29 can be converted into the probability of dying before age 3, and so forth (Brass, et al., 1968, pp. 104-120).

The estimates of infant mortality derived from the Brass method are unfortunately often less accurate than the derived

estimates of child mortality. This is due to random error because of the small proportion of women aged 15-19 who have borne children, a typically high infant mortality among teenage mothers, and the sensitivity of the infant mortality estimate to the shape of the fertility pattern. As a result, when using the Brass method demographers have obtained estimates of infant mortality by extrapolating from the estimates of mortality at later childhood ages. This extrapolation can lead to a large range of error in the infant mortality estimate because of the less-than-perfect relationship between infant mortality and childhood mortality. For example, according to frequently used model mortality patterns (Coale and Demeny, 1966), 165 out of every 1,000 births dying before age 3 could correspond to an infant mortality rate anywhere within the range of 110 to 130 infant deaths per 1,000 live births.

In addition, the Brass method assumes that fertility and mortality have been roughly constant in the recent past. Fertility has been roughly constant in many of the countries under consideration. However, in countries where fertility is declining rapidly, Brass estimates will tend to overstate mortality. When mortality rates are falling, as they have been in almost all of the countries considered here, the results of the Brass method are not estimates of current mortality but of average mortality over the preceding 4 to 8 years. As a result this method is not very useful for estimating mortality trends in the years preceding the survey or census.<sup>10</sup>

It is important to emphasize that infant and child mortality estimates derived from the Brass method are almost always biased on the low side since living children are usually better reported than dead children. For example, the results of applying this method to the 1971 census data from (Nepal, 1973) gave estimates of infant and child mortality similar to a country with life expectancy at birth between 53 and 58 years. The life expectancy at birth in Nepal in 1971 is thought to be closer to 42 years (United Nations, 1975b). With respect to this method, Brass concludes that "after all the available data and evidence have been surveyed, the most convincing mortality estimates are often the childhood rates derived by the method described . . . . Although the estimates are scarcely precise, they appear to establish a value of childhood mortality acceptable as a valid lower bound of the true rate" (Brass, et al., 1968, p. 105).

In those cases when data from special questions in surveys and censuses for estimating the level and trend of infant mortality have been unavailable or are unusable, demographers have turned to analysis of the country's population age distribution to obtain estimates of mortality. In countries with high or moderately high mortality, changes in adult or overall mortality often occur simultaneously with changes in infant mortality. As a result, when there is evidence of large declines in adult or overall mortality, it is often inferred that infant mortality is also declining. When the population can be assumed to be quasi-stable (age-specific fertility constant, mortality constant or declining, and no international migration), its age

<sup>10</sup> Recent several demographers have been investigating techniques for using data on children ever born and children surviving to estimate levels and trends in infant and child mortality under conditions of declining mortality. See, for example, Feeney (1976).

distribution can be compared to model stable populations and very rough estimates of the underlying mortality can be determined. This method not only gives a very rough estimate of the level of infant mortality, but if applied to age distributions at different points of time, and if large declines in mortality are implied, it can possibly also be inferred that infant mortality has declined. In addition, when age distributions are available for two points in time, such as from two censuses, and no international migration occurred between the two dates, it is sometimes possible to use a method known as the census survival technique to estimate the level of adult mortality between the two dates, even if the population is not quasi-stable. By comparing the level of adult mortality with those of model mortality patterns, a rough estimate of infant mortality can be obtained for the intercensal or intersurvey period. If adult mortality can be thus estimated for two different periods (for example if three censuses are available), and again if large declines in adult mortality are occurring, it may be that infant mortality is also declining.

When vital registration data are available but of too low quality to be usable for the direct estimate of infant mortality, it has been suggested that two indirect indices of infant mortality change—changes in the age distribution of infant deaths and changes in the cause of death distribution of infant deaths—can be calculated from the vital registration data.

It has been observed that as infant mortality declines the death rate under 1 month of age declines very slowly, whereas the death rate at ages 1 month to 1 year declines much more rapidly (United Nations, 1954, pp. 32-40). As a result, the proportion of infant deaths under 1 month of age increases as overall infant mortality decreases. Unfortunately, analyses at the U.S. Bureau of the Census have indicated that under conditions of incomplete infant death registration, especially when completeness may change over time, the age distribution of registered infant deaths is not a very sensitive indicator of infant mortality change. For example, in the Philippines the registered proportion of infant deaths under 1 month fluctuated between 45 and 50 percent during the 1952-72 period (United Nations, 1957, 1967b, and 1975a) even though infant mortality is believed to have declined considerably during this period (United Nations, 1975b).

The second indirect index available from vital registration data is change in the cause-of-death distribution. Historically, as infant mortality has declined, the proportion of infant deaths due to parasitic, infectious, and respiratory diseases has also declined. However, in developing countries with a high level of deaths of unknown causes and only low percentages of causes of death that are medically certified, the information on cause of death is very unreliable and does not appear to be a satisfactory indicator of infant mortality change. In the Philippines, for example, the percent of registered infant deaths due to parasitic, infectious, and respiratory diseases has actually increased since the mid-1950's while infant mortality is estimated to have dropped sharply. Therefore, it appears that neither of the indirect indices of change in infant mortality obtainable from vital registration data are useful, reliable measures.<sup>11</sup>

<sup>11</sup> See appendix tables 3 and 5 for information on availability of data on age distribution of infant deaths and causes of infant deaths.

## AVAILABILITY AND QUALITY OF DATA FOR MEASURING INFANT MORTALITY

The previous section of this paper dealt with the procedures for estimating infant mortality from various sources of data. This section will concentrate on the availability, timeliness, and quality of data from each of these sources.<sup>12</sup> The discussion, as well as all tables, will be limited to the 52 countries under investigation. These 52 countries, however, reflect the range of problems encountered in measuring infant mortality in most developing countries.

### Vital Registration

High quality vital registration systems provide the best data for the annual measurement of levels and trends in infant mortality. This section presents information on the availability, timeliness, and quality of such data.

Although 34 of the 52 countries have vital registration systems, 8 of these 34 have systems with less than national coverage (see table B). Some of these systems cover only the capital city; others cover two or three provinces. Data from this type of registration system can be used to measure infant mortality only in the area covered by the system.

**Table B. Number of Countries by Geographic Area and Availability and Coverage of Vital Registration Systems**

Geographic area	Total	No vital registration system	Countries with vital registration system		
			Total	Less than national coverage	National coverage
Total....	52	18	34	8	26
Africa.....	21	12	9	6	3
Asia.....	13	5	8	1	7
Latin America	18	1	17	1	16

Source: Appendix table A-1.

National vital registration systems are most common in Latin America. Of the 18 Latin American countries under investigation, only Haiti and Brazil do not have national systems. However, in Africa only three countries (Egypt, Tunisia, and Kenya) have national registration systems.

In order to make current estimates of infant mortality, annual data on registered births and infant deaths must be published on a regular and timely basis. Data are available for the year 1973 or later for 18 of the 26 countries with national registration systems (see table C). Only two countries, Bolivia

<sup>12</sup> The tables in this section were compiled after an exhaustive search through U.S. Bureau of the Census country files, survey and census questionnaires, and other published and unpublished materials. Nevertheless, some available data sources may have been unintentionally omitted from this inventory.

and the Republic of Korea, do not have any data available for the 1970's.

**Table C. Number of Countries With National Vital Registration Systems, by Geographic Area and Year of Latest Available Information**

Year	Total	Africa	Asia	Latin America
Total.....	<u>26</u>	<u>3</u>	<u>7</u>	<u>16</u>
1970-75.....	24	3	6	15
1975.....	3	-	-	3
1974.....	8	1	2	5
1973.....	7	2	2	3
1972.....	3	-	1	2
1971.....	1	-	-	1
1970.....	2	-	1	1
1965-69.....	1	-	-	1
1960-64.....	1	-	1	-

- Represents zero.

Source: Appendix table A-1.

The usefulness of data from vital registration systems for measuring levels and trends in infant mortality is limited by their quality. Only 11 of the 52 countries have data of sufficient quality to make national estimates of infant mortality (see table D). The data on registered infant deaths for six of these countries are 90 to 100 percent complete. Registration of infant deaths in the other five countries is only 75 to 89 percent complete, but it may be possible to adjust for underregistration either by internal analysis of the data or by comparison with independent estimates of the infant mortality rate from surveys or censuses.

**Table D. Number of Countries With National Vital Registration Systems, by Geographic Area and Percent Completeness of Infant Death Registration**

Geographic area	Total	Estimated completeness			
		Less than 50 percent	50 to 74 percent	75 to 89 percent	90 to 100 percent
Total....	<u>26</u>	<u>12</u>	<u>3</u>	<u>5</u>	<u>6</u>
Africa.....	3	1	1	1	-
Asia.....	7	6	-	-	1
Latin America	16	5	2	4	5

- Represents zero.

Source: Appendix table A-2.

Of the 11 countries with adequate data on infant deaths, 9 are located in Latin America. Only one Asian country (Sri Lanka) and one African country (Egypt) have data that are above 75 percent complete.

## Surveys and Censuses

In this section information will be presented on the availability, timeliness, and quality of infant mortality data from national surveys and censuses. The only surveys and censuses which are considered here are those which have published data relevant to infant mortality.

Of the 52 countries considered in this paper, 41 have available data on infant mortality from surveys or censuses (see table E). Of the 11 countries that do not have such infant mortality data available, 4 are in Africa (Egypt, Sierra Leone, Sudan, and Zaire), 1 is in Asia (Yemen Arab Republic), and 6 are in Latin America (Chile, Guyana, Haiti, Panama, Peru, and Uruguay).

Although most of the countries have collected infant mortality data, many of the surveys or censuses were not conducted recently and thus current estimates of infant mortality are unavailable from these sources (see table F). The data are very recent for the Asian countries and moderately recent for Latin American countries, but quite old for African countries.

**Table E. Number of Countries With Infant Mortality Data Available From National Surveys or Censuses Since 1960, by Geographic Area**

Geographic area	Total	Countries with survey or census data
Total.....	<u>52</u>	<u>41</u>
Africa.....	21	17
Asia.....	13	12
Latin America.....	18	12

Source: Appendix table A-1.

**Table F. Number of Countries by Geographic Area and Year of Most Recent National Survey or Census With Available Infant Mortality Data**

Year	Total	Africa	Asia	Latin America
Total.....	<u>52</u>	<u>21</u>	<u>13</u>	<u>18</u>
1970-75.....	28	6	11	11
1975.....	2	-	-	2
1974.....	3	1	1	1
1973.....	8	1	4	3
1972.....	3	-	1	2
1971.....	9	4	4	1
1970.....	3	-	1	1
1965-69.....	7	6	1	-
1960-64.....	6	5	-	1
None since 1960	11	4	1	6

- Represents zero.

Source: Appendix table A-1.

The information presented so far deals with the availability of data at only one point in time. To make current estimates of the trend in infant mortality, either continuous surveys or a series of ad hoc surveys or censuses must be available. Two countries considered in this report—India and Lesotho—have continuous surveys. For the remaining countries, a series of ad hoc surveys or censuses is necessary to estimate infant mortality trends. Of the 52 countries, 16 have the necessary survey or census information at 2 or more points in time and 7 have information at 3 or more points in time (see table G). Only in Asia do the majority of countries have survey or census data available for two or more points in time. Nevertheless, it must be remembered that availability of data at two points in time does not mean that the data are consistent and of the necessary quality to measure changes in infant mortality.

Infant mortality data must be published on a timely basis to be useful for measuring current levels and trends. Information on timeliness of publication was collected for 29 of the 52 countries. In general, countries appear to be reasonably prompt in publication. Almost one-third of these 29 countries published results within 1 year of the survey or census date and almost three-fifths publish within 2 years of the enumeration. The data, though, must often be evaluated and adjusted before usable infant mortality rates can be derived. This, of course, adds further delay.

**Table G. Number of Countries by Geographic Area and Number of National Surveys or Censuses With Available Infant Mortality Data Since 1960**

Geographic area	Total countries	Number of countries by number of national surveys or censuses				
		0	1	2	3	4 or more
Total.....	52	11	25	9	3	4
Africa.....	21	4	13	3	1	-
Asia.....	13	1	3	3	2	4
Latin America.	18	6	9	3	-	-

- Represents zero.

Source: Appendix table A-1.

The collection and publication of infant mortality data must be followed by analysis of the quality of the data. Unfortunately, such analysis is often difficult. Although infant mortality rates derived from survey or census data can sometimes be adjusted by demographic analysis, the rates often must be accepted or rejected solely on the basis of their plausibility and consistency. For Africa, survey or census data have been utilized by analysts at the U.S. Bureau of the Census to make infant mortality estimates for only 10 of the 17 countries which had such data. For six African countries, the U.S. Bureau of the Census was not able to utilize the survey or census results and as a result made no estimates of infant mortality. For Asia, survey or census data were utilized for 7 of the 12 countries. In spite of the existence of survey or census data, for three Asian countries no estimate was made. For Latin America, survey or census data

were utilized for only 3 of the 12 countries. However, for five of the Latin American countries infant mortality rates were derived from a preferred system—vital registration. For four Latin American countries no estimate was made although either survey or census data were available. Therefore, for almost one-third of the 41 countries with survey or census data, the U.S. Bureau of the Census has rejected the survey or census results and has made no estimate.<sup>13</sup>

The countries referred to in table G are those with available infant mortality data from a survey or census. In addition there are many countries that have conducted surveys or censuses but have not yet released the data. Of the 52 countries under investigation, 16 have taken a survey or census since 1970 that is known to have included questions relevant to infant mortality, but from which data are not yet available (see appendix table A-1). Five of these countries are in Africa, five are in Latin America, and six are in Asia.

Various international organizations have shown an interest in sponsoring or aiding countries in conducting surveys. These surveys vary in type and subject matter. A series of ad hoc surveys of infant and early childhood mortality and fertility patterns are currently being conducted in five member countries of the World Health Organization (WHO). They are being financed by the United Nations Fund for Population Activities and are being conducted jointly by the governments of the host countries and by WHO. These surveys are multiround followup surveys, with the initial round designed to provide retrospective information on the base population and on the vital events that have occurred in the households. Along with studying levels and determinants of infant and child mortality, a major purpose of these surveys is to compare followup questions and retrospective questions as to their usefulness in measuring infant and child mortality. Presently only 2 of the 52 countries considered (Sudan and Sierra Leone) are participating in this survey program. In neither case are the surveys national.

Infant mortality data may also be available in the future from the African Household Survey Program (United Nations, 1976). Efforts are underway to assist African countries in developing continuous household surveys in order to collect "demographic, social and related economic data in a continuous and integrated manner" (United Nations, 1976, p. 3). The survey program is still at the planning stage, but it is envisioned as a program offering technical and financial assistance to 30 countries in the African region. There is as yet no definite commitment as to sponsorship nor have any surveys been scheduled. When these surveys get underway it is likely that infant mortality will be included as an important demographic variable.

The World Fertility Survey (WFS) began in 1972 under the auspices of the International Statistical Institute and with the collaboration and cooperation of the United Nations, the U.S. Agency for International Development, and the International Union for the Scientific Study of Population. The purpose of the WFS is to assist interested countries to carry out nationally representative and comparable sample surveys on fertility. While the focus of the surveys is upon fertility behavior, the core questionnaire contains retrospective questions which permit the

<sup>13</sup>Other published documents that provide similar evaluations of survey and census data on infant mortality on a worldwide basis have not been found. Nevertheless, in discussing demographic estimation in statistically underdeveloped countries, the U.S. Bureau of the Census (1975, p. 836) states, "Experience indicates that the measurement of mortality remains very difficult even by means of dual system."

estimation of infant and child mortality rates. Although WFS data relevant to infant mortality are not yet available for any of the 52 countries, these surveys may provide new IMR estimates in the future (see table H).

**Table H. Number of Countries in Which World Fertility Survey (WFS) Field Work Was Conducted or is Planned, by Year and Geographic Area: 1974 to 1978**

(Figures relate to the 52 countries considered in this paper)

Year	Total	Africa	Asia	Latin America
Total.....	<u>52</u>	<u>21</u>	<u>13</u>	<u>18</u>
1978.....	6	4	1	1
1977.....	9	4	1	4
1976.....	5	-	3	2
1975.....	8	-	4	4
1974.....	1	-	1	-
Interest indicated..	8	5	1	2
No WFS participation	15	8	2	5

- Represents zero.

Source: Appendix table A-1.

## CONCLUSION—THE FEASIBILITY OF MEASURING AND REPORTING PROGRESS IN REDUCING INFANT MORTALITY

In the previous sections the procedures for estimating infant mortality were reviewed and the availability, timeliness, and quality of the necessary data in 52 selected countries of the developing world were described. In this section the following questions are addressed: (1) for how many countries is it possible to measure the levels and trends of infant mortality on an annual basis; (2) for how many countries can levels and trends be measured, although less frequently; and (3) is it feasible to prepare annual reports on infant mortality trends?

Annual data on infant mortality can come from either of two sources: a national vital registration system or a national ongoing continuous survey. Unfortunately, neither reliable vital registration systems nor ongoing continuous surveys are common in the developing world. Among the 52 countries considered in this report, only 11 have reliable vital registration systems and only 2 have ongoing continuous surveys. Of the 11 countries with reliable vital registration systems, 9 are in Latin

America—Chile, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Jamaica, Panama, and Uruguay. The remaining two countries are Sri Lanka and Egypt. For these 11 countries the levels and trends of infant mortality can be measured annually with satisfactory reliability.

In addition, two other countries, India and Lesotho, have continuous surveys. The Sample Registration System (a dual system) in India has been collecting infant mortality data since 1968. Unfortunately, recent survey reports have not included infant mortality rates. As a result the latest available rates are for 1971. Lesotho has temporarily stopped its continuous survey to prepare for the 1976 census, and it is not clear whether the survey will resume after completion of the census. As a result, current annual estimates of infant mortality may not be available in the future for India and Lesotho.

In the absence of reliable vital registration systems and ongoing continuous surveys, countries must rely on intermittent ad hoc surveys and censuses for estimating levels and trends in infant mortality. Most countries have infant mortality data available from at least one survey or census and hence, if the data are reliable, have an estimate of infant mortality at one point in time. Only 16 countries have data available for 2 or more surveys or censuses and only 7 have data available for 3 or more. Therefore, if the data are reliable, it may be possible to estimate the trend in infant mortality in these countries, although not annually. The seven countries that have data available from three or more surveys or censuses are Ghana, Bangladesh, Indonesia, the Republic of Korea, Nepal, Pakistan, and the Philippines.

Therefore, it appears that the levels and trends of infant mortality can be measured on an annual basis as of now for only the 11 countries with reliable vital registration systems. In addition, it may be possible to measure infant mortality levels and trends on an intermittent basis in other countries as they take surveys and censuses and the results of these enumerations are evaluated and adjusted.

Given the limited potential to measure infant mortality trends on an annual basis, it does not presently appear justifiable to prepare annual reports on infant mortality. Even in countries with reliable vital registration systems or with ongoing continuous surveys, calculated infant mortality rates may rise and fall annually, solely because of random fluctuations or special 1-year occurrences, without indicating a changing mortality trend. Among countries dependent upon ad hoc surveys and censuses, infant mortality estimates do not become available often enough to justify annual reports. Consequently, reports containing substantially new data on progress being made to reduce infant mortality on a worldwide basis could be prepared perhaps only once every 3 or 4 years. Reports prepared more frequently would have little new data to present, except perhaps for the Latin American region.

## APPENDIX

**Table A-1. National Surveys and Censuses Conducted Since 1960 Containing Data Relevant to Infant Mortality, Latest Available Year of Vital Registration Data, and Date of Commencement of the World Fertility Survey (WFS) Field Work for 52 Less Developed Countries**

Country	Survey or census containing data relevant to infant mortality	Year of latest vital registration data <sup>1</sup>	Commencement of WFS field work
AFRICA			
Botswana.....	1971 Census	(NA)	(NA)
Cameroon.....	1960-65 Five Regional Surveys (1976 Census)	(NA)	1977
Chad.....	1963-64 Enquête Démographique au Tchad <sup>2</sup>	(NA)	(NA)
Egypt.....	(1960 Census) (1966 Census) † (1976 Census) †	1974	1978
Ethiopia.....	1964-67 National Sample Survey 1968-71 National Sample Survey <sup>3</sup>	(NA)	(NA)
Ghana.....	1960 Post Enumeration Survey (1965-66 Ghana Fertility Survey) (1966 Ghana Population Survey) † 1968-69 National Demographic Sample Survey 1971 Supplementary Enquiry to the 1970 Census	(4)	1978
Kenya.....	1962 Census 1969 Census	1973	1977
Lesotho.....	(1967-68 Demographic Component of the Rural Household Consumption and Expenditure Survey) <sup>5</sup> 1971-(Present) Demographic Component of the Rural Household Consumption and Expenditure Survey <sup>5</sup> (1976 Census) †	(NA)	1977
Liberia.....	1969-71 Population Growth Survey (1974 Census)	(NA)	(NA)
Mali.....	1960-61 Enquête Démographique	(NA)	(*)
Mauritania.....	1964-65 Enquête Démographique <sup>6</sup>	(NA)	(*)
Morocco.....	1961-63 Enquête à Objectifs Multiples 1972-73 National Demographic Survey and Vital Registration Study	(7)	(*)
Niger.....	1959-60 Etude Démographique	(NA)	(NA)
Nigeria.....	1965-66 Rural Demographic Survey <sup>8</sup> (1971-73 National Fertility, Family and Family Planning Survey) (1973 Demographic Survey) †	(9)	(*)
Senegal.....	1960-61 Enquête Démographique Nationale (1970-71 Enquête Démographique) †	(10)	1978

See footnotes at end of table.

**Table A-1. National Surveys and Censuses Conducted Since 1960 Containing Data Relevant to Infant Mortality, Latest Available Year of Vital Registration Data, and Date of Commencement of the World Fertility Survey (WFS) Field Work for 52 Less Developed Countries—Continued**

Country	Survey or census containing data relevant to infant mortality	Year of latest vital registration data <sup>1</sup>	Commencement of WFS field work
AFRICA--Continued			
Sierra Leone.....	(1969-70 Fertility and Family Planning Survey) (1971-72 Survey on Demographic Aspects of Marriage) (1974 Census) †	( <sup>11</sup> )	(NA)
Sudan.....	(1973 Census) †	(NA)	1977
Tanzania.....	1967 Census (1973-74 National Demographic Survey)	( <sup>12</sup> )	(*)
Tunisia.....	1968-69 Enquête Nationale Démographique (1976 Census) †	1973	1978
Upper Volta.....	1960-61 Enquête Démographique	(NA)	(NA)
Zaire.....	(NA)	(NA)	(NA)
ASIA			
Afghanistan.....	1972-73 National Demographic and Family Guidance Survey	(NA)	(NA)
Bangladesh.....	1960 Housing Census 1962-65 Population Growth Estimation Experiment 1968-69 National Impact Survey 1974 Bangladesh Retrospective Survey of Fertility and Mortality	(NA)	1975
India.....	1961-1969 National Sample Survey 1970-(Present) Sample Registration Scheme (1971-72 Fertility Survey)	1970	(*)
Indonesia.....	(1961-63 National Population Survey) 1964-65 Socio-Economic Survey (1969 Socio-Economic Survey) † 1971 Census 1973 Fertility and Mortality Survey (1976 Intercensal Population Survey)	( <sup>13</sup> )	1976 <sup>14</sup>
Jordan.....	1961 Census 1972 National Fertility Sample Survey <sup>16</sup>	1974 <sup>15</sup>	1976 <sup>16</sup>
Korea, Republic of.....	(1960 Post Enumeration Survey) 1964-67 National Surveys on Family Planning 1966 Special Demographic Survey (1968 Fertility and Family Planning Survey) 1970 Census (1970 Post Enumeration Survey)	1964	1974

See footnotes at end of table.

Table A-1. National Surveys and Censuses Conducted Since 1960 Containing Data Relevant to Infant Mortality, Latest Available Year of Vital Registration Data, and Date of Commencement of the World Fertility Survey (WFS) Field Work for 52 Less Developed Countries—Continued

Country	Survey or census containing data relevant to infant mortality	Year of latest vital registration data <sup>1</sup>	Commencement of WFS field work
ASIA--Continued			
Korea, Republic of--Con.	(1970-71 Korean Attitude and Birth Control Behavior Survey) 1971 Fertility-Abortion Survey (1971 Special Demographic Survey) † (1972-Present Continuous Demographic Survey) † 1973 National Family Planning and Fertility Survey (1975 Census)		
Nepal.....	1961 Census (1963 Population Survey) † 1965-66 Nepal Health Survey 1971 Census	(NA)	1976
Pakistan.....	1960 Housing Census 1962-65 Population Growth Estimation Experiment 1968-69 National Impact Survey 1968-71 Population Growth Survey (1973 Housing, Economic, and Demographic Survey)	(NA)	1975
Philippines.....	1960 Census 1964 Birth and Death Registration Survey (1965 Family Limitation Survey) 1968 National Demographic Survey 1970 Census 1971-73 Vital Rate Estimation Survey (1972 Survey of Knowledge, Attitude and Practice of Family Planning) 1973 National Demographic Survey (1975 Census) †	1974	1978
Sri Lanka.....	1969-70 Socio-Economic Survey 1971 Census	1973	1975
Syrian Arab Republic.....	1970 Census	1972 <sup>17</sup>	1977
Thailand.....	1964-67 Survey of Population Change (1969-71 National Longitudinal Survey of Social, Economic and Demographic Change) (1970 Census) (1974-75 Survey of Population Change) †	1973	1975
Yemen Arab Republic.....	(NA)	(NA)	(NA)

See footnotes at end of table.

Table A-1. National Surveys and Censuses Conducted Since 1960 Containing Data Relevant to Infant Mortality, Latest Available Year of Vital Registration Data, and Date of Commencement of the World Fertility Survey (WFS) Field Work for 52 Less Developed Countries—Continued

Country	Survey or census containing data relevant to infant mortality	Year of latest vital registration data <sup>1</sup>	Commencement of WFS field work
LATIN AMERICA			
Bolivia.....	1975 National Demographic Survey (1976 Census)	1966	(NA)
Brazil.....	(1968-Present Pesquisa Nacional por Amostra de Domicilios) 1970 Census	( <sup>18</sup> )	(NA)
Chile.....	(1970 Census)	1975	1977
Colombia.....	(1965-66 National Investigation of Morbidity) † 1969 National Fertility Survey 1973 Census	1970 <sup>19</sup>	1976
Costa Rica.....	1973 Census	1974	1976
Dominican Republic.....	(1969-71 National Demographic Survey) 1970 Census (1974 Diagnos Survey) †	1974	1975
Ecuador.....	(1965-67 Encuestas de Fecundidad Levantada en las Principales Ciudades, en Algunas Parroquias Rurales de País y en las Ciudades de Quito y Guayaquil) 1974 Census	1974 <sup>20</sup>	1977
El Salvador.....	1971 Census 1975 Encuesta Nacional de Fecundidad	1975	(NA)
Guatemala.....	1964 Census 1973 Census	1973	1978
Guyana.....	(NA)	1971	1975
Haiti.....	(1971 Census) † (1972 National Demographic Survey) †	-	1977
Honduras.....	(1961 Post Enumeration Survey) † 1970-72 Encuesta Demográfica Nacional de Honduras (1974 Census)	1974	(NA)
Jamaica.....	1960 Census (1967-Present Continuous Social and Demographic Survey) † (1971-72 Fertility, Mating and Contraceptive Survey) †	1974	1975
Nicaragua.....	1971 Census	1973	(NA)
Panama.....	(NA)	1975	1975
Paraguay.....	1972 Census	1973	(*)

See footnotes at end of table.

**Table A-1. National Surveys and Censuses Conducted Since 1960 Containing Data Relevant to Infant Mortality, Latest Available Year of Vital Registration Data, and Date of Commencement of the World Fertility Survey (WFS) Field Work for 52 Less Developed Countries—Continued**

Country	Survey or census containing data relevant to infant mortality	Year of latest vital registration data <sup>1</sup>	Commencement of WFS field work
LATIN AMERICA--Continued			
Peru.....	(1969 Encuesta de Fecundidad) (1972 Census) † (1975-76 National Demographic Survey)	1972	1977
Uruguay.....	(1975 Census) †	1972	(*)

Note: This table was compiled after an exhaustive search through U.S. Bureau of the Census country files, survey and census questionnaires, and other published and unpublished materials. Nevertheless, some available data sources may have been unintentionally omitted from this inventory.

NA Not available. Country does not have this data collection system.

(Title) Indicates that the data are not yet available.

† Denotes uncertainty as to whether data relevant to infant mortality were collected.

\* Country has indicated interest in participating in WFS.

<sup>1</sup>Latest year for which data on births and infant deaths are available. <sup>2</sup>Excludes data for approximately 22 percent of the total population not covered by survey. <sup>3</sup>Data are for rural population only, which comprised 90 percent of the total population in 1971. <sup>4</sup>Available registration data are not nationally representative; there are 153 compulsory registration systems which covered approximately 35 percent of the total population in 1969. <sup>5</sup>The rural population comprised 95 percent of the total population at the time of the 1966 census. <sup>6</sup>Excludes data for approximately 9 percent of total population not covered by survey. <sup>7</sup>Data available only for 1960-62 and only for 13 major cities, although the system has wider coverage. <sup>8</sup>The rural population comprised 84 percent of the total population at the time of the 1963 census. <sup>9</sup>Data available for Lagos only. Latest year available 1973. <sup>10</sup>Data available for Dakar only. Latest year available 1972. <sup>11</sup>Data available for Western Area only. Latest year available 1968. <sup>12</sup>Data available for Zanzibar only. Latest year available 1967. <sup>13</sup>Data available for 1962 only and for registration units (regencies) in Java and Madura only, although the system has wider coverage. <sup>14</sup>The WFS was the third stage of the 1976 Intercensal Population Survey. <sup>15</sup>Since 1967, data on deaths have been available for East Bank only. Data on births are available for all of Jordan. <sup>16</sup>East Bank only. <sup>17</sup>Excludes nomad population and Palestinian refugees. <sup>18</sup>Brazil has data on births for the whole country, however data on infant deaths are available only for selected urban areas. <sup>19</sup>Data are from baptisms and burial permits. In 1970, new legislation revised the civil registration system. Implementation has been gradual. Birth registration scheduled to cover the entire country in 1977. Coverage of deaths expected to begin in 1977. <sup>20</sup>Excludes nomadic Indian tribes. <sup>21</sup>Excludes Indian jungle population.

Source: Samuel Baum, et al., The World Fertility Survey Inventory: Major Fertility and Related Surveys Conducted in (Africa, Asia, Latin America): 1960-73, Occasional Papers Nos. 3, 4, and 5, International Statistical Institute, n.d.; International Statistical Institute, The World Fertility Survey: Semi-Annual Report, January 1976-June 1976, n.d.; United Nations, Demographic Yearbook, various issues; United Nations, Population and Vital Statistics Report, various issues; unpublished computer printouts from the Pan American Health Organization; and national government publications.

Table A-2. Estimated Percent Completeness of Birth and Infant Death Registration for 26 Less Developed Countries With National Vital Registration Systems: Latest Available Year

("B" denotes Birth Registration, "I" denotes Infant Death Registration)

Country	Under 50 percent	50 to 74 percent	75 to 89 percent	90 percent and over
AFRICA				
Egypt.....	-	-	I	B
Kenya.....	B, I	-	-	-
Tunisia.....	-	I	-	B
ASIA				
India.....	B, I	-	-	-
Jordan.....	I <sup>1</sup>	-	-	B
Korea, Republic of.....	I	-	B	-
Philippines.....	I	B	-	-
Sri Lanka.....	-	-	-	B, I
Syrian Arab Republic.....	I	B	-	-
Thailand.....	I	-	B	-
LATIN AMERICA				
Bolivia.....	B, I	-	-	-
Chile.....	-	-	-	B, I
Colombia <sup>2</sup> .....	-	I	B	-
Costa Rica.....	-	-	-	B, I
Dominican Republic.....	I	-	B	-
Ecuador.....	-	-	B, I	-
El Salvador.....	-	-	I	B
Guatemala.....	-	-	-	B, I
Guyana.....	-	-	-	B, I
Honduras.....	I	-	B	-
Jamaica.....	-	-	I	B
Nicaragua.....	I	-	-	B
Panama.....	-	-	I	B
Paraguay.....	I	-	B	-
Peru.....	-	I	B	-
Uruguay.....	-	-	-	B, I

<sup>1</sup>Since 1967 data on deaths have been available for East Bank only. records and burial permits.

<sup>2</sup>Data are from baptismal

Source: Registered data from United Nations, Demographic Yearbook, various issues; United Nations, Population and Vital Statistics Report, various issues; and national government publications. Levels of completeness are based on official evaluations and evaluations conducted at the U.S. Bureau of the Census.

Table A-3. Year of Latest Available Data on Infant Deaths, by Age for 26 Less Developed Countries With National Vital Registration Systems: 1960 to Present

Country	Deaths under 1 day	Deaths under 1 week	Deaths under 1 month
AFRICA			
Egypt.....	1972	1972	1972
Kenya.....	(NA)	1969	1970
Tunisia.....	(NA)	1971	1971
ASIA			
India.....	(NA)	1970	1970
Jordan <sup>1</sup> .....	(NA)	(NA)	1973
Korea, Republic of.....	(NA)	(NA)	(NA)
Philippines.....	1972	1972	1972
Sri Lanka.....	(NA)	1968	1968
Syrian Arab Republic.....	(NA)	(NA)	(NA)
Thailand.....	1972	1972	1972
LATIN AMERICA			
Bolivia.....	(NA)	(NA)	(NA)
Chile.....	1971	1971	1975
Colombia <sup>2</sup> .....	1967	1967	1967
Costa Rica.....	1973	1973	1973
Dominican Republic.....	1974	1974	1974
Ecuador <sup>3</sup> .....	1972	1972	1974
El Salvador.....	1973	1973	1973
Guatemala.....	1970	1970	1971
Guyana.....	(NA)	(NA)	1960-61
Honduras.....	1974	1974	1974
Jamaica.....	1965	1965	1965
Nicaragua.....	(NA)	(NA)	1965
Panama.....	1973	1973	1974
Paraguay.....	(NA)	1972	1972
Peru <sup>4</sup> .....	1970	1970	1970
Uruguay.....	1971	1971	1971

NA Data on infant deaths are not available for this category.

<sup>1</sup>Since 1967 data on deaths have been available for East Bank only. <sup>2</sup>Data are from burial permits. <sup>3</sup>Excludes nomadic Indian tribes. <sup>4</sup>Excludes Indian jungle population.

Source: United Nations, Demographic Yearbook, various issues; World Health Organization, World Health Statistics Annual, various issues; unpublished printouts from the Pan American Health Organization; and national government publications.

Table A-4. Infant Mortality Rates, by Age for the United States and 26 Less Developed Countries With National Vital Registration Systems: Latest Available Year Since 1960

(Rate is number of deaths per 1,000 live births)

Country	Deaths under 1 day		Deaths under 1 week	
	Latest available year since 1960	Rate	Latest available year since 1960	Rate
United States.....	1974	6.7	1974	10.7
AFRICA				
Egypt.....	1972	0.4	1972	6.8
Kenya.....	(NA)	(NA)	1969	29.1
Tunisia.....	(NA)	(NA)	1971	11.5
ASIA				
India.....	(NA)	(NA)	1970	18.3
Jordan.....	(NA)	(NA)	(NA)	(NA)
Korea, Republic of.....	(NA)	(NA)	(NA)	(NA)
Philippines.....	1972	8.8	1972	22.3
Sri Lanka.....	(NA)	(NA)	1968	22.4
Syrian Arab Republic.....	(NA)	(NA)	(NA)	(NA)
Thailand.....	1972	0.7	1972	3.7
LATIN AMERICA				
Bolivia.....	(NA)	(NA)	(NA)	(NA)
Chile.....	1971	8.6	1971	18.4
Colombia <sup>1</sup> .....	1967	9.1	1967	20.6
Costa Rica.....	1973	7.8	1973	14.8
Dominican Republic.....	1974	4.1	1974	13.5
Ecuador <sup>2</sup> .....	1972	2.9	1972	10.3
El Salvador.....	1973	4.3	1973	10.9
Guatemala.....	1970	6.5	1970	16.9
Guyana.....	(NA)	(NA)	(NA)	(NA)
Honduras.....	1974	1.7	1974	6.2
Jamaica.....	1965	3.0	1965	11.6
Nicaragua.....	(NA)	(NA)	(NA)	(NA)
Panama.....	1973	4.3	1973	11.0
Paraguay.....	(NA)	(NA)	1972	9.0
Peru.....	1970	4.2	1970	13.0
Uruguay.....	1971	7.1	1971	16.5

NA Data not available for any year since 1960.

<sup>1</sup>Data are from baptisms and burial permits.

<sup>2</sup>Excludes nomadic Indian tribes.

Source: U.S. National Center for Health Statistics, Vital Statistics of the United States, 1974, Vol. II, Part B, 1976; United Nations, Demographic Yearbook, various issues; World Health Organization, World Health Statistics Annual, various issues; unpublished printouts from the Pan American Health Organization; and national publications of the country concerned.

Table A-5. Percent of Infant Deaths of Unknown Cause and Percent of Total Deaths Medically Certified for 26 Less Developed Countries With National Vital Registration Systems: Latest Available Year Since 1960

Country	Infant deaths, by cause		Total deaths <sup>1</sup> medically certified	
	Latest available year since 1960	Percent unknown cause	Latest available year since 1960	Percent of total deaths
AFRICA				
Egypt.....	1971	(Z)	(NA)	(NA)
Kenya.....	(NA)	(NA)	(NA)	(NA)
Tunisia.....	(NA)	(NA)	(NA)	(NA)
ASIA				
India.....	(NA)	(NA)	(NA)	(NA)
Jordan <sup>2</sup> .....	1973	1	1973	61
Korea, Republic of.....	1960	13	(NA)	(NA)
Philippines.....	1971	5	1969	27
Sri Lanka.....	1963	3	1967	16
Syrian Arab Republic.....	(NA)	(NA)	(NA)	(NA)
Thailand.....	1971	56	(NA)	(NA)
LATIN AMERICA				
Bolivia.....	(NA)	(NA)	(NA)	(NA)
Chile.....	1975	11	1975	76
Colombia <sup>3</sup> .....	1970	8 <sup>4</sup>	1970	67
Costa Rica.....	1974	8	1974	76
Dominican Republic.....	1974	33	1971	46
Ecuador <sup>5</sup> .....	1974	12	1973	48
El Salvador.....	1973	32	1973	37
Guatemala.....	1971	12	1971	22
Guyana.....	(NA)	(NA)	(NA)	(NA)
Honduras.....	1974	32	(NA)	(NA)
Jamaica.....	1973	(Z) <sup>6</sup>	1970	95
Nicaragua.....	1965	(Z)	(NA)	(NA)
Panama.....	1974	19	1973	62
Paraguay.....	1971	17	1967	38 <sup>4</sup>
Peru.....	1972	7	1970	57
Uruguay.....	1973	7	1972	99

NA Data not available for any year since 1960.

Z Less than 0.5 percent.

<sup>1</sup>Total deaths include infant deaths as well as deaths at all other ages. <sup>2</sup>Since 1967, data on deaths have been available for East Bank only. <sup>3</sup>Data are from burial permits. <sup>4</sup>Excludes deaths for which tabulation of deaths by cause was not available. <sup>5</sup>Excludes nomadic Indian tribes. <sup>6</sup>Data available for medically certified deaths only.

Source: United Nations, Demographic Yearbook, various issues; World Health Organization, World Health Statistics Annual, various issues; unpublished printouts from the Pan American Health Organization; and national government publications.

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