

Ranking Countries by Infant Mortality Rates

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IN recent years, considerable interest at the national level has revolved around the question: Where does the United States stand in relation to other countries of the world with regard to infant mortality? Interest in the subject has been expressed by the executive and legislative branches of Federal Government; by major components of the Department of Health, Education, and Welfare; by the press and individual citizens. A typical statement is the following, which appeared in a national magazine (1):

The state of our nation's health is bad. We rank far below less affluent countries. In preventing infant deaths, the United States stands tenth; in deaths from diabetes, fourteenth; from heart disease, thirteenth; in overall deaths, fifth. And in prolonging life, we are eighth.

These are simple statements meant for the lay public and are easily understood.

One of the statistical indices named in the statement, the infant mortality rate, has frequently been ranked in recent reports and articles. When, however, different persons or agencies have ranked countries according to their infant mortality rates, the position of the United States has varied from 10th to 28th. From the viewpoint of both scientific and public policy, such wide variation is less than desirable. Moreover, it clouds the basic issue, that is, the position of the United States as gauged by its infant mortality rate.

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One of the simplest statistical techniques for comparing quantitative data is to arrange them in the order of magnitude and to assign rank order numbers to the observations. Rank order numbers may be assigned from the lowest to the highest observation, or vice versa, depending on the subject under study.

The rank is generally used as a simple descriptive device for nontechnical audiences or as the first observation in the examination of new subject matter. The infant mortality rates themselves are more meaningful statistics than their ranked positions, and for general utility these rates would usually be selected for study. However, because of the wide general use of the rank, a convention is needed to achieve uniform results and to avoid confusion.

Since the procedure of ranking is relatively simple, to what can the wide variations in results be attributed? The inconsistencies originate from a number of sources. They may spring from the use of different sources for the infant mortality rates which constitute the statistical series. They may be due to different definitions of a "country." The variations may result from acceptance or rejection of the official vital statistics of some countries because of the quality of their data. They may be due to technical decisions regarding the acceptance or rejection of provisional rates and to the use of rates for another year concurrently with those of the year under study. In any event, the lack of uniform results clouds the issue, and an undue amount of effort is spent in reconciling differences.

The National Center for Health Statistics

is one of the agencies which is often contacted for ranked lists of countries. The need for a uniform procedure for ranking infant mortality rates was apparent, and the cooperation of statisticians in other parts of the Department of Health, Education, and Welfare was solicited. This report resulted from discussions among the statisticians of three agencies—the Children's Bureau, the National Center for Health Statistics, and the National Institute for Child Health and Human Development. The purpose of these discussions was to coordinate methods and to develop guides by which infant mortality rates could be ranked in a uniform manner. The need for uniformity was accepted although the development of a uniform procedure implied that it would, to some degree, be arbitrary. The Statistical Office of the United Nations assisted in providing information and in clarifying ambiguous or troublesome issues. The method described is the one agreed to by the three agencies and is the one which will be used by the National Center for Health Statistics in preparing future rankings of countries according to their infant mortality rates.

Source of the Data

Infant mortality rates are available from a number of publications, all derived from a single basic source—the national statistical services of the individual countries. Annually, the Statistical Office of the United Nations in New York publishes a Demographic Yearbook, providing demographic statistics for the data year and information on trends. The yearbook routinely contains certain basic demographic data, and annual infant mortality rates are available from this source.

The Statistical Office of the United Nations also publishes a quarterly Population and Vital Statistics Report which contains the most recent data available on a limited number of demographic characteristics, including annual infant mortality rates.

The World Health Organization, Geneva, publishes a monthly Epidemiological and Vital Statistics Report. In addition to other health statistics, it contains quarterly and annual data on infant mortality.

The rates shown in these publications are all based on data provided by the national statisti-

cal services of the various countries, but not necessarily for the same periods. In view of the several sources of available published data, it is not surprising that rankings of infant mortality rates produced by different persons have not always produced uniform results. The rates may be based on any single source of information or combination of sources, but if a uniform procedure for use by a number of persons is contemplated, the source should be the same. After the scope of the various publications had been evaluated, the Demographic Yearbook was designated as the basic source of information. The ranking of countries by their infant mortality rates for any given data year will be prepared as soon as the yearbook is released. This annual ranking will suffice for general informational purposes. The following presentation describes the method used to obtain the 1966 ranking.

Definitions

In order to establish a common base, a clear understanding is needed of the question to be answered. In brief, the question may be stated as follows: Where does the United States stand in comparison with other countries when they are ranked by their infant mortality rates? Let us acknowledge that the statistic is useful as a crude comparative device. Let us also assume that, in addition to the rank number, we desire to recognize countries with rates which are higher than those of the United States as well as countries with rates which are lower. Furthermore, to meet the expressed needs for current information, the rank should be timely.

Several components of the posed question need more precise definition.

United States. The United States includes the 50 States and the District of Columbia.

Infant mortality rate. The definition of the infant mortality rate is the standard one, namely, the ratio of deaths among infants under 1 year of age in a calendar year to the live births in that same year, expressed as a rate per 1,000 live births.

Country. The operational definition of a "country" and the selection of countries to be included in the list is not as straightforward as that for the infant mortality rate. For present purposes, a country is defined in accord with the

self-governing (sovereign) status indicated in the Demographic Yearbook of the United Nations for the year under study. For 1966, this information appears in table 2 of that publication. Only countries which are self-governing are considered for possible inclusion in the ranking; the operational definition is further limited to countries which were in that status for the entire year. In effect, the definition eliminates territories and possessions such as Angola, Bermuda, Greenland, and Guam. A change in the self-governing status of countries could affect the number of countries listed and therefore affect the rankings from year to year. Singapore, which became a self-governing country in August 1965, was not a candidate for ranking in 1965 but is a candidate for 1966. Since new countries evolve at irregular intervals, the list of countries must be reexamined annually.

Other specific problems need to be handled individually and, at times, arbitrarily. Whether England and Wales, and Scotland are to be handled as two countries or as one entity—the United Kingdom—affects the number of countries in the list and, perhaps, the rank of the United States. The Union of Soviet Socialist Republics presents a similar problem since it is composed of a number of republics. Because of the unavailability of data for each of the separate republics, the Union of Soviet Socialist Republics is deemed to be a “country” and, although the data for the constituent parts of the United Kingdom are available, it is also considered one country.

Another problem results from the unusual status of Germany, which presently consists of the Federal Republic of Germany, the German Democratic Republic (Eastern Germany), East Berlin, and West Berlin. Again, the decision is an arbitrary one. The two parts of Berlin are not considered to be countries, but the two republics are treated as separate countries.

Final List of Countries

In addition to the preceding considerations, two other criteria are used to limit the final list of countries: the completeness of the coverage of the vital statistics registration and the population size of the country.

From country to country, the quality of the

data produced by vital statistics systems varies greatly. The tentative list of countries obtained from the Demographic Yearbook contains a number of countries which exclude significant portions of births and deaths from the calculation of infant mortality rates and some countries which evaluate certain components of their vital statistics as unreliable (2). For several countries, significant numbers of births and infant deaths are omitted from the official statistics because of certain registration requirements or certain statistical practices. For China (Taiwan), for example, the data do not include live born infants who die before the birth is registered. Because of the high mortality that prevails soon after birth, this procedure results in a significant understatement of infant mortality. As a consequence, China (Taiwan), which was on the tentative list, is not included in the final list. Before 1965, data for Czechoslovakia did not include “deaths of infants born alive after less than 28 weeks’ gestation, of less than 1,000 grammes in weight and 35 centimeters in length, who died within 24 hours of birth.” Beginning with 1965, however, the statistics for Czechoslovakia were adjusted for this artifact, and Czechoslovakia is included in the list of selected countries beginning with 1965.

A second selection based on registration completeness was made. Annually, the Statistical Office of the United Nations asks each country to indicate whether its birth and death registers are relatively complete, that is, whether they represent at least 90 percent coverage of the events which are required to be registered by law. The data for a large number of countries are rated as not having complete registers, or sometimes the country fails to respond to the question. Countries selected for the final ranking procedure are those which indicated that they had complete (at least 90 percent) registration for the entire country for the data year. In the 1966 Demographic Yearbook, this information is shown in table 7 for live births, and in table 13 for infant deaths. Columbia, Cuba, Iraq, and Israel are examples of countries which are excluded from the final list because their statistics are not complete. The self-evaluation of “complete,” although it may sometimes be open to question, is accepted in the absence of better information. Many countries

which are excluded for this reason are developing countries—in fact, a considerable portion of Africa, Asia, and South America consists of countries which are excluded because of the quality of their data.

A third selection was required because the data for some countries were complete for only certain segments of the population. For ex-

ample, African countries with complete registration for the population of European stock but unreliable statistics for the native population were excluded from the final list for 1966. On the other hand, Australia, which omits the aborigines, and Denmark, which omits the inhabitants of the Faroe Islands and Greenland, were included because these omissions have rela-

Table 1. Estimated population and live births, 1966, and annual infant mortality rates, 1961-66, for selected countries

Country	Estimated population, 1966 (in thousands)	Live births 1966	Infant mortality rates 1961-66 (deaths under 1 year per 1,000 live births)					
			1966	1965	1964	1963	1962	1961
Sweden.....	7,808	123,000	-----	13.3	14.2	15.4	15.4	15.8
Netherlands.....	12,455	239,588	-----	14.4	14.8	15.8	17.0	17.0
Norway.....	3,753	65,296	¹ (1965)	-----	16.4	16.9	17.7	17.9
Finland.....	4,639	77,640	-----	17.6	17.0	18.2	20.5	20.8
New Zealand.....	2,676	60,192	-----	17.7	19.5	19.1	19.6	20.4
Switzerland.....	6,050	109,623	-----	17.8	19.0	20.5	21.2	21.0
Australia.....	11,541	222,628	-----	18.2	18.5	19.1	19.5	20.4
Japan.....	98,865	1,356,440	-----	18.5	20.4	23.2	26.4	28.6
Denmark.....	4,797	88,091	-----	18.7	18.7	19.1	20.1	21.8
United Kingdom.....	54,965	978,700	-----	19.6	19.6	20.6	21.8	22.4
France.....	49,400	863,310	-----	21.7	22.0	23.3	25.4	25.6
Eastern Germany.....	15,988	268,909	² 23.2	² 24.5	² 28.6	31.4	31.6	33.7
United States.....	196,920	3,629,000	-----	23.4	24.8	25.2	25.3	25.3
Canada.....	19,919	390,376	-----	23.6	24.7	26.3	27.6	27.2
Czechoslovakia.....	14,240	222,501	-----	23.7	25.3	(³)	(³)	(³)
Federal Republic of Germany.....	57,485	1,024,045	-----	23.8	25.2	26.9	29.2	31.7
Belgium.....	9,528	150,636	-----	24.1	25.3	27.2	27.5	28.1
Singapore.....	1,914	54,708	-----	24.6	(⁴)	(⁴)	(⁴)	(⁴)
Ireland.....	2,885	62,143	-----	24.9	25.2	26.6	29.1	30.5
Union of Soviet Socialist Republics.....	233,180	¹ (1965) 4,253,000	-----	26.5	27	29	30.9	32
Austria.....	7,290	128,158	-----	28.1	28.3	29.2	31.3	32.7
Bulgaria.....	8,258	125,791	¹ (1965)	-----	32.2	30.8	32.9	35.7
Greece.....	8,612	155,678	-----	33.7	(⁵)	(⁵)	(⁵)	(⁵)
Spain.....	31,871	666,433	-----	34.6	37.3	37.9	40.5	41.6
Trinidad and Tobago.....	1,000	29,370	-----	-----	(⁶)	(⁶)	(⁶)	(⁶)
Jamaica.....	1,839	69,768	¹ (1965)	-----	35.4	36.7	40.7	53.3
Italy.....	51,859	981,537	-----	35.6	36.1	40.1	41.8	40.7
Hungary.....	10,179	138,493	-----	38.8	40.0	42.9	47.9	44.1
Poland.....	31,698	530,300	-----	41.8	47.7	48.7	54.8	54.1
Romania.....	19,143	273,536	-----	46.5	44.1	48.6	55.2	60.3
Mexico.....	44,145	1,909,600	-----	60.7	64.5	68.5	69.9	70.2
El Salvador.....	3,037	137,256	-----	61.7	70.6	65.0	67.7	71.4
Portugal.....	9,218	205,776	-----	65.0	64.9	69.0	73.1	78.6
Yugoslavia.....	19,756	398,785	-----	71.5	75.8	77.5	84.2	82.0
Costa Rica.....	1,486	58,060	¹ (1965)	-----	75.1	86.1	74.1	70.7
Albania.....	1,914	65,127	-----	86.8	81.5	90.6	92.1	79.5
Guatemala.....	4,575	202,432	-----	91.5	94.6	87.9	92.8	84.8
Chile.....	8,750	274,580	¹ (1965)	-----	107.1	114.2	110.9	114.6

¹ 1965 data were used for reasons indicated in text.

² Includes data for East Berlin.

³ Rate is not shown because data exclude deaths of infants born alive after less than 28 weeks' gestation who were less than 1,000 grams in weight and 35 centimeters in length and who died within 24 hours of birth.

⁴ Country was not an independent sovereign country for the entire year.

⁵ Estimates or incomplete data.

⁶ Estimated population was less than 1 million.

NOTE: Italics indicate that data are provisional; leaders (..) indicate that data were not available.

SOURCE: Demographic Yearbook, 1966. United Nations, New York, 1967, tables 2, 7, and 14.

tively little effect on the infant mortality rates for these countries.

Completeness of registration was by far the most restrictive of the criteria used in constructing the final list of countries. In the actual process of preparing a new list, this criterion should be the first one applied to the tentative list of self-governing countries to minimize the clerical work.

The tentative list also included some very

small countries with populations no larger than a medium-sized city in the United States. Iceland, for example, had an estimated population of only 189,000 in 1964, compared with a population of 192 million for the United States (table 2 of the 1966 Demographic Yearbook). To exclude such very small countries, an estimated population of at least 1 million (unrounded) in the data year was arbitrarily set as the minimum population to qualify a country

Table 2. Annual and 3-year average infant mortality rates for selected countries, 1961-65

Country	Annual rates					3-year average rates		
	1965	1964	1963	1962	1961	1963-65	1962-64	1961-63
Sweden.....	13.3	14.2	15.4	15.4	15.8	14.3	15.0	15.5
Netherlands.....	14.4	14.8	15.8	17.0	17.0	15.0	15.9	16.6
Norway.....	16.4	16.4	16.9	17.7	17.9	17.0	17.0	17.5
Finland.....	17.6	17.0	18.2	20.5	20.8	17.6	18.6	19.8
New Zealand.....	19.5	19.1	19.6	20.4	22.8	19.4	19.7	20.9
Switzerland.....	17.8	19.0	20.5	21.2	21.0	19.1	20.2	20.9
Australia.....	18.5	19.1	19.5	20.4	19.5	19.0	19.7	19.8
Japan.....	18.5	20.4	23.2	26.4	28.6	20.7	23.3	26.1
Denmark.....	18.7	18.7	19.1	20.1	21.8	18.8	19.3	20.3
United Kingdom.....	19.6	20.6	21.8	22.4	22.1	20.7	21.6	22.1
France.....	22.0	23.3	25.4	25.7	25.6	23.6	24.8	25.6
Eastern Germany.....	¹ 24.5	¹ 28.6	31.4	31.6	33.7	(²)	(²)	32.2
United States.....	24.7	24.8	25.2	25.3	25.3	24.9	25.1	25.3
Canada.....	23.6	24.7	26.3	27.6	27.2	24.9	26.2	27.0
Czechoslovakia.....	25.3	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Federal Republic of Germany.....	23.8	25.2	26.9	29.2	31.7	25.3	27.1	29.3
Belgium.....	24.1	25.3	27.2	27.5	28.1	25.6	26.7	27.6
Singapore.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Ireland.....	25.2	26.7	26.6	29.1	30.5	26.2	27.5	28.7
Union of Soviet Socialist Republics.....	27	29	30.9	32	32	29	31	32
Austria.....	28.3	29.2	31.3	32.8	32.7	29.6	31.1	32.3
Bulgaria.....	30.8	32.9	35.7	37.3	37.8	33.2	35.3	36.9
Greece.....	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)
Spain.....	37.3	37.9	40.5	41.6	46.2	39.0	40.0	42.8
Trinidad and Tobago.....	(⁶)	(⁶)	(⁶)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Jamaica.....	36.7	40.7	53.3	50.5	48.8	43.4	48.1	50.9
Italy.....	35.6	36.1	40.1	41.8	40.7	37.2	39.3	40.9
Hungary.....	38.8	40.0	42.9	47.9	44.1	40.6	43.6	45.0
Poland.....	41.8	47.7	48.7	54.8	54.1	46.2	50.4	52.5
Romania.....	44.1	48.6	55.2	60.3	71.4	49.4	54.7	62.3
Mexico.....	60.7	64.5	68.5	69.9	70.2	64.5	67.6	69.5
El Salvador.....	70.6	65.0	67.7	71.4	70.0	67.8	68.0	69.7
Portugal.....	64.9	69.0	73.1	78.6	88.8	69.0	73.6	80.2
Yugoslavia.....	71.5	75.8	77.5	84.2	82.0	74.9	79.2	81.2
Costa Rica.....	75.1	86.1	74.1	70.7	65.3	78.3	76.8	70.1
Albania.....	86.8	81.5	90.6	92.1	79.5	86.3	88.1	87.4
Guatemala.....	94.6	87.9	92.8	91.3	84.8	91.8	90.7	89.6
Chile.....	107.1	114.2	110.9	114.6	111.2	110.7	113.3	112.3

¹ Includes data for East Berlin.

² Average rate is not computed because data for 1964-65 include East Berlin while data for 1961-63 exclude East Berlin.

³ Rate is not computed because data exclude deaths of infants born alive after less than 28 weeks' gestation who were less than 1,000 grams in weight and 35 centimeters in length and who died within 24 hours of birth.

⁴ Country was not an independent sovereign country for the entire period.

⁵ Data were not complete.

⁶ Estimated population was less than 1 million.

NOTE: Leaders (---) indicate that data were not available; italics indicate that data are provisional.

for inclusion in the final list of selected countries (table 1). This population size was considered large enough to provide relatively stable infant mortality rates. The application of this criterion resulted in the exclusion of several countries, such as Iceland, Liechtenstein, and Luxembourg.

For 1966, these procedures resulted in the list of 38 selected countries (named in table 1), each of which has complete registration and an estimated population of at least 1 million. This list

may not remain precisely the same for any number of years because of newly evolving nations, improvements in registration of births and infant deaths, or increases in population.

Time Base

Another question to be resolved is the time base to use in comparing rates. Do annual rates provide satisfactory data for this purpose or would 3-year, or perhaps 5-year, averages be

Table 3. Final and provisional annual infant mortality rates for selected countries, 1961-64

Country	1964		1963		1962		1961	
	Final	Provisional	Final	Provisional	Final	Provisional	Final	Provisional
Sweden	14.2	13.6	15.4	15.0	15.4	15.3	15.8	15.5
Netherlands	14.8		15.8	15.8	17.0	(1)	17.0	(1)
Norway	16.4	16.7	16.9		17.7		17.9	
Finland	17.0	16.9	18.2	18.0	20.5	19.2	20.8	19.8
New Zealand	19.1		19.6		20.4	20.3	22.8	
Switzerland	19.0		20.5		21.2		21.0	20.8
Australia	19.1		19.5		20.4		19.5	
Japan	20.4	20.4	23.2	23.2	26.4	26.5	28.6	28.8
Denmark	18.7	18.7	19.1	19.1	20.1	20.1	21.8	
United Kingdom	20.6	20.7	21.8	21.1	22.4	22.1	22.1	22.1
France	23.3	23.4	25.4	26.6	25.7	25.9	25.6	26.1
Eastern Germany	² 28.6	² 29.5	31.4	31.4	31.6	² 31.1	33.7	² 33.3
United States	24.8		25.2	25.2	25.3	25.4	25.3	25.2
Canada	24.7		26.3		27.6		27.2	
Czechoslovakia	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Federal Republic of Germany	25.2		26.9	26.9	29.2	29.2	31.7	31.7
Belgium	25.3		27.2	28.3	27.5	28.3	28.1	26.2
Singapore	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Ireland	26.7	26.8	26.6	26.7	29.1	24.2	30.5	
Union of Soviet Socialist Republics	29		30.9		32	32	32	
Austria	29.2	29.9	31.3	31.5	32.8	33.2	32.7	32.9
Bulgaria	32.9	32.2	35.7	35.3	37.3		37.8	
Greece	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Spain	37.9	37.9	40.5	40.7	41.6	42.3	46.2	46.8
Trinidad and Tobago	(5)	(5)	(5)	(5)	(4)	(4)	(4)	(4)
Jamaica	40.7	39.2	53.3	49.2	50.5	48.2	48.8	47.2
Italy	36.1	35.5	40.1	39.5	41.8	40.5	40.7	40.1
Hungary	40.0	39.8	42.9	42.6	47.9	47.6	44.1	43.9
Poland	47.7	47.8	48.7	49.1	54.8	55.6	54.1	54.9
Romania	48.6		55.2	55.3	60.3		71.4	71.0
Mexico	64.5		68.5		69.9	70.1	70.2	70.3
El Salvador	65.0	65.5	67.7	67.9	71.4	71.5	70.0	
Portugal	69.0		73.1		78.6	78.6	88.8	88.5
Yugoslavia	75.8	76.0	77.5	77.5	84.2	81.5	82.0	82.2
Costa Rica	86.1	86.4	74.1		70.7	76.7	65.3	71.9
Albania	81.5		90.6		92.1		79.5	
Guatemala	87.9	91.6	92.8		91.3		84.8	
Chile	114.2		110.9	111.0	114.6		111.2	

¹ Estimates or incomplete data.

² Includes data for East Berlin.

³ Rate is not shown because data exclude deaths of infants born alive after less than 28 weeks' gestation who were less than 1,000 grams in weight and 35 centi-

meters in length and who died within 24 hours of birth.

⁴ Country was not an independent sovereign country for the entire year.

⁵ Estimated population was less than 1 million.

NOTE: Leaders (---) indicate that data were not available.

preferable? To some extent the answer depends on the data themselves, to some extent on the use to which the data are to be put.

In general, one of the primary reasons for grouping the data for a number of years is to eliminate wide fluctuations. Infant mortality rates, however, do not fluctuate widely, but proceed in a generally declining pattern for almost all countries on the selected list (table 2). Notable exceptions are the last six countries on the list, whose rates would not affect the rank of the United States. The impression derived from the 3-year averages is the same as from the

Table 4. Infant mortality rates for selected countries, 1966

Rank	Country	Rate ¹
1	Sweden (1965)	13.3
2	Netherlands (1965)	14.4
3	Norway (1964)	16.4
4	Finland (1965)	17.6
5	New Zealand	17.7
6	Switzerland (1965)	17.8
7	Australia	18.2
8	Japan (1965)	18.5
9	Denmark (1965)	18.7
10	United Kingdom	19.6
11	France	21.7
12	Eastern Germany ²	23.2
13	United States	23.4
14	Canada (1965)	23.6
15	Czechoslovakia	23.7
16	Federal Republic of Germany (1965)	23.8
17	Belgium (1965)	24.1
18	Singapore	24.6
19	Ireland	24.9
20	Union of Soviet Socialist Republics	26.5
21	Austria	28.1
22	Bulgaria	32.2
23	Greece	33.7
24	Spain	34.6
25	Trinidad and Tobago (1964)	35.3
26	Jamaica	35.4
27	Italy (1965)	35.6
28	Hungary (1965)	38.8
29	Poland (1965)	41.8
30	Romania	46.5
31	Mexico (1965)	60.7
32	El Salvador	61.7
33	Portugal	65.0
34	Yugoslavia (1965)	71.5
35	Costa Rica (1965)	75.1
36	Albania (1965)	86.8
37	Guatemala	91.5
38	Chile (1965) ³	107.1

¹ Deaths under 1 year per 1,000 live births.

² Includes data for East Berlin.

³ Rate is computed on live births which have been adjusted upward 5 percent for underregistration.

NOTE: Italics indicate that data are provisional.

SOURCE: Demographic Yearbook, 1966. United Nations, New York, 1967.

annual rates, but the observations are reduced from the five annual rates to a maximum of three averages for each country.

A second consideration in deciding between annual rates and 3-year averages is the timeliness of the information. For example, for Sweden, an infant mortality rate of 13.3 in 1965 is more timely information than a rate of 14.3 in 1963-65. Also, the rates for Sweden declined from 15.8 in 1961 to 13.3 in 1965, a decline in infant mortality of 2.5 per 1,000 births. The 3-year average rates declined from 15.5 in 1961-63 to 14.3 in 1963-65, a difference of 1.2, which is less than half of the difference observed in the annual rates. Differences of this magnitude between annual rates and 3-year averages can be observed for a number of the countries in the upper half of the list (for example, for Netherlands, Finland, and Japan). Obviously, in the present situation, the use of moving averages results in loss of sensitivity. Furthermore, although the rates for the United States are not changing rapidly, the nation's rank has changed enough to warrant attention to annual rates in preference to 3-year or 5-year averages.

Another reason often given for grouping data for a number of years is that such a procedure compensates for small denominators which sometimes produce unstable rates. By limiting the selected countries to those with a minimum population of at least 1 million, the smallest number of live births in any denominator was 29,370 (Trinidad and Tobago). This number provides an adequate base for rates expressed in terms of 1,000 live births.

Based on these considerations, annual rates were chosen for use in ranking the selected countries with regard to infant mortality rates.

Selection of Rate

In compiling the infant mortality data for any given year, the ideal procedure would be to use the final rate for each country. If, however, the procedure of using final rates were strictly adhered to, preparation of the table for any given data year would be delayed by perhaps as much as 3 years, thus defeating the objective of timeliness. In the Demographic Yearbook, the Statistical Office of the United Nations shows provisional data when the final data are not yet

available. If differences between final and provisional rates are small, we might consider using a provisional rate in place of a final rate.

To assess the differences between provisional and final data, the rates shown in the Demographic Yearbooks for the 6 years 1961-66 were reviewed. However, comparisons between the provisional and final data for 1965 and 1966 could be made for so few countries that these years are omitted from table 3. For a few countries, more than one provisional rate or final rate was found. In these rare instances, the final rate in the most recent yearbook and the provisional rate in the yearbook for the data year were used. In this way, the differences were maximized for evaluative purposes. Two countries were omitted from the comparison, namely, Eastern Germany for 1961 and 1962—because the provisional rates included East Berlin while the final rates did not—and the Union of Soviet Socialist Republics for 1962—because no decimals were shown with the rates.

Following is a summary of the absolute differences in annual infant mortality rates for 1961-64:

<i>Absolute difference</i>	<i>Number of countries</i>			
	<i>1964</i>	<i>1963</i>	<i>1962</i>	<i>1961</i>
Total countries.....	20	23	22	20
<0.5.....	12	18	13	12
0.5-0.9.....	6	2	3	4
1.0-1.4.....	---	2	2	1
1.5-1.9.....	1	---	---	2
2.0-2.9.....	---	---	2	---
3.0-3.9.....	1	---	---	---
4.0-4.9.....	---	1	1	---
5.0-5.9.....	---	---	---	---
6.0-6.9.....	---	---	1	1

From the raw data, the following summary figures were derived:

<i>Item</i>	<i>1964</i>	<i>1963</i>	<i>1962</i>	<i>1961</i>
Number of countries...	20	23	22	20
Range of differences.....	0.0-3.7	0.0-4.1	0.0-6.0	0.0-6.6
Average difference.....	0.5	0.4	1.0	0.8

The range of the differences in rates was reduced between 1961 and 1964. The average difference was reduced from 0.8 to 0.5. The countries with large differences had rates so far in excess of those of the United States that their rates would not affect its rank.

If both the final and provisional rates for another country are lower than the rate for the United States, it would make no difference which was used for ranking purposes—the rank for the United States would remain unchanged regardless of which rate was used. The same rationale applies when both the final and provisional rates for another country are higher than the rate for the United States. If the provisional and final rates for another country straddle the rate for the United States, the rank of the United States could be affected. If this were a frequent occurrence, it would be an argument against the use of a provisional rate in place of a final rate. For the first 20 countries on the list, there was generally little relative difference between the provisional and final rates in the 4 years 1961-64. In only one of these 20 countries in any of the 4 years—Ireland in 1962—would the difference have affected the rank of the United States. If subsequent years continue to demonstrate the same close relationship between provisional and final rates, then the use of a provisional rate for a final one in the absence of the final rate appears reasonable.

Therefore, in selecting the rate to be used in ranking, the following order of preference is observed: The final rate for the data year is preferred. In its absence, the provisional rate is acceptable. If neither of these rates is available, the same order of preference is observed with regard to the data for the previous year; the year that is used is shown in parentheses. For 1966, these alternatives made it possible to include a rate for each of the 38 countries included in the final list (table 4).

Once the rate is selected, the countries can be ordered in sequence, with the lowest rate first. Countries with equal rates are arranged alphabetically.

Assignment of Rank

After the sequence of the countries in the final list is determined, the final step in the procedure is the assignment of rank numbers as shown in table 4. In 1966, the United States ranked 13th among the countries selected for ranking.

In assigning ranks, the selected rates received equal consideration, regardless of whether they were final or provisional rates, or whether they

were the rates for the year in question or for the preceding year. In instances in which the rates for two or more countries are numerically identical, the same rank is assigned and enough rank numbers are bypassed to allow for the number of countries whose rates are tied before the next rank number is assigned. While there were no ties in table 4, in the previous year three pairs of countries had equal rates—Australia and Japan, Canada and the United States, and Czechoslovakia and Ireland. In that year, the United States and Canada both ranked 15th.

Ranking represents a starting point, and only a starting point, in the investigation of infant mortality or, for that matter, any other health problem. The rank remains a crude statistic, and in a very practical way its crudeness demands that it be relatively simple to derive and easy to understand. To further elaborate the procedure would not automatically increase its value or utility.

Conclusion

This report describes the rationale of a procedure developed for ranking countries by their infant mortality rates. The method was developed by the National Center for Health Statistics in collaboration with statisticians from the Children's Bureau and the National Institute for Child Health and Human Development. Their purpose was to arrive at a procedure for their own use which would yield consistent results, and which, in the hands of other users, would yield the same results. Its application should help to eliminate the wide range of answers which are presently given to questions about the rank of the United States with regard to infant mortality.

REFERENCES

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Aspirin and Ulcers

Aspirin may contribute to the formation of gastric ulcers, according to Dr. René Menguy and Dr. Martin H. Max of the Pritzker School of Medicine of the University of Chicago.

Investigation has shown that aspirin taken orally significantly impairs the ability of cells to produce a protective mucous coating. More recently, research with dogs has shown that aspirin administered so that it does not come into contact with stomach lining causes an increased loss of cells from the lining, which is obviously due to the action of circulating aspirin and not to a direct action of aspirin on the mucosa. The decrease of cells not compensated for by an increase in cell reproduction could lead to ulcer formation.

Aspirin is consumed at the rate of more than 20 million pounds per year in the United States. The administration of aspirin to patients with various conditions requiring it, or by self-administration by patients, is often complicated by gastrointestinal bleeding.

Previously, damage to the stomach lining from aspirin has been assumed to result from

a direct irritation of partially dissolved aspirin on the gastric mucosa. This explanation, however, is virtually completely invalidated by the researchers' observations that aspirin can cause the same gastric mucosal injury if administered so that it cannot come in contact with the stomach lining. In addition, since aspirin does not increase acid secretion by the stomach, aspirin-induced hyperacidity cannot be a factor.

The research also indicated that aspirin impairs the mechanisms normally responsible for protecting stomach lining from its own acid. These mechanisms consist of a layer of mucous constantly increased by the cells lining the stomach and by the ability of these cells to regenerate. Investigation has shown that aspirin does interfere with this cell production.

This research study, sponsored by the Public Health Service, was reported at the 54th Annual Clinical Congress of the American College of Surgeons in Atlantic City, N.J., on October 16, 1968.