

UNITED STATES DEPARTMENT OF LABOR  
FRANCES PERKINS, SECRETARY

CHILDREN'S BUREAU

Katharine E. Learoot, Chief

LIBRARY

Agricultural & Mechanical College of Texas

College Station, Texas.

# Comparability of Maternal Mortality Rates in the United States and Certain Foreign Countries

A STUDY OF THE EFFECTS OF VARIATIONS IN  
ASSIGNMENT PROCEDURES, DEFINITIONS OF  
LIVE BIRTHS, AND COMPLETENESS OF BIRTH  
REGISTRATION

BY

ELIZABETH C. TANDY, D. Sc.

*Bureau Publication No. 229*



UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1935

For sale by the Superintendent of Documents, Washington, D. C.

Price 5 cents

LIBRARY

Agricultural and Mechanical College of Texas

Donor: [Illegible]

[Illegible text, likely a title or description of the book]



CONTENTS

	Page
Letter of transmittal.....	v
Method of study.....	1
Proportion of deaths assigned to puerperal and nonpuerperal causes by the different countries.....	5
Differences in methods of assignment to puerperal and nonpuerperal causes in the different countries.....	8
Maternal mortality rates that would have obtained in the United States under methods of assignment of various foreign countries.....	9
Comparison of the United States rate for deaths assigned to the puerperal state with those for all deaths associated with pregnancy and childbirth in six foreign countries.....	13
Trend of maternal mortality in the United States and certain foreign countries....	14
Effect of differences in definitions of live births and in completeness of registration.	16
Summary and conclusions.....	19
Recommendations.....	21
List of references.....	22



LETTER OF TRANSMITTAL

UNITED STATES DEPARTMENT OF LABOR,  
CHILDREN'S BUREAU,  
*Washington, December 3, 1934.*

MADAM: There is transmitted herewith a report on the Comparability of Maternal Mortality Rates in the United States and Certain Foreign Countries. The study was initiated by the Subcommittee on Comparability of Maternal Mortality Rates of the Committee on Prenatal and Maternal Care of the White House Conference on Child Health and Protection. Dr. Elizabeth C. Tandy, Director of the Statistical Division of the Children's Bureau, who was chairman of the subcommittee, was in charge of the study and has written the report.

The study included analysis of foreign laws and registration practices and the special analysis of a representative group of United States death certificates on which pregnancy or childbirth was mentioned by the certifying physician. These certificates had been assembled by the Bureau of the Census. At the request of the subcommittee they were transmitted by the Bureau of the Census to officials in charge of vital statistics in 24 foreign countries, with the request that they indicate in each instance whether under their practice the death would be assigned to a puerperal or a nonpuerperal cause. Replies were received from 16 countries.

The report has the approval of Dr. F. L. Adair, Chairman of the Committee on Prenatal and Maternal Care, and that of the members of the subcommittee: Dr. W. J. V. Deacon, Director of the Bureau of Records and Statistics, State Department of Health, Michigan; Dr. Haven Emerson, Professor of Public Health Administration, College of Physicians and Surgeons, Columbia University; John O. Spain, Assistant Director, Division of Vital Statistics, State Department of Health, New York; Dr. T. F. Murphy, Chief Statistician for Vital Statistics, United States Bureau of the Census, and Dr. Tandy. Valuable suggestions were also received from the following, who approved the report: Grace Abbott, formerly Chief of the Children's Bureau; Dr. Robert E. Chaddock, Professor of Sociology and Statistics, Columbia University; Dr. James R. McCord, Professor of Obstetrics and Gynecology, Emory University School of Medicine; and Dr. Lowell J. Reed, Professor of Biostatistics, School of Hygiene and Public Health, Johns Hopkins University.

Respectfully submitted.

KATHARINE F. LENROOT, *Chief.*

HON. FRANCES PERKINS,  
*Secretary of Labor.*

# REPORT OF THE

COMMISSIONERS OF THE

FEDERAL RESERVE BANK OF ST. LOUIS

FOR THE YEAR ENDING DECEMBER 31, 1914

The Federal Reserve Bank of St. Louis was organized on January 16, 1914, under the authority of the Federal Reserve Act of December 23, 1913. It is one of the twelve Federal Reserve Banks established by the Act, and is a member of the Federal Reserve System. The Bank is organized as a corporation, with the Federal Reserve Board of Governors as the controlling authority. The Board of Governors is composed of seven members, appointed by the President of the United States, and the Federal Reserve Bank of St. Louis is one of the twelve member banks of the System.

The Federal Reserve Bank of St. Louis has a capital of \$10,000,000, and is authorized to issue Federal Reserve Notes to the amount of \$10,000,000. The Bank is organized into three classes of stock, and the total amount of stock owned by the public is \$10,000,000. The Bank is organized into three classes of stock, and the total amount of stock owned by the public is \$10,000,000. The Bank is organized into three classes of stock, and the total amount of stock owned by the public is \$10,000,000.

The Federal Reserve Bank of St. Louis has a capital of \$10,000,000, and is authorized to issue Federal Reserve Notes to the amount of \$10,000,000. The Bank is organized into three classes of stock, and the total amount of stock owned by the public is \$10,000,000. The Bank is organized into three classes of stock, and the total amount of stock owned by the public is \$10,000,000.

The Federal Reserve Bank of St. Louis has a capital of \$10,000,000, and is authorized to issue Federal Reserve Notes to the amount of \$10,000,000. The Bank is organized into three classes of stock, and the total amount of stock owned by the public is \$10,000,000. The Bank is organized into three classes of stock, and the total amount of stock owned by the public is \$10,000,000.

# Comparability of Maternal Mortality Rates in the United States and Certain Foreign Countries<sup>1</sup>

## *Method of Study*

This report deals with the similarities and differences in methods of assigning cause to deaths certified to be associated with pregnancy and childbirth in the United States and 16 foreign countries and discusses the effect of the differences in assignment upon the comparability of the official maternal mortality rates. It includes a brief discussion of the effect of variations in the definition of live births and in the completeness of birth registration.

The term "deaths associated with pregnancy or childbirth" is used to include all deaths in which a condition of pregnancy or childbirth is stated on the death certificate by the physician who registered the death. Such deaths are of two main types:

(1) Deaths due directly to the puerperal state. These include all deaths in which the condition of pregnancy or childbirth is the only cause mentioned on the death certificate, and deaths in which a nonpuerperal disease is mentioned jointly with the puerperal, the nonpuerperal disease being one which probably would not have proved fatal except for the pregnancy or childbirth.

(2) Deaths due to nonpuerperal causes in which the puerperal condition existed concurrently but in which the nonpuerperal condition would probably have proved fatal even if the condition of pregnancy or childbirth had not been present.

It is obvious that the great majority of deaths associated with pregnancy and childbirth would everywhere be classified in the first group. Certain types of deaths, however, such as abortions induced for non-therapeutic reasons which would be classified as puerperal in some coun-

---

<sup>1</sup> This report covers one section of an investigation initiated through a subcommittee of the Committee on Prenatal and Maternal Care of the White House Conference on Child Health and Protection, of which Dr. Fred L. Adair was chairman. This subcommittee on comparability and trend of maternal mortality rates was charged with investigation of the factors underlying the similarities and differences in the official figures of the important countries of the world and exposition of the general characteristics of the rates. The complete investigation is expected ultimately to cover the definitions of live births and stillbirths that obtain in the various countries, description of the procedure of registration, methods of assigning cause of death to deaths certified as associated with pregnancy and childbirth, description of the trend of the rates, and interpretation of the findings. The study was begun during the early months of the White House Conference, but it was impossible to complete any part of it in time for inclusion in the report of the Committee on Prenatal and Maternal Care.

## COMPARABILITY OF MATERNAL MORTALITY RATES

tries, would be called nonpuerperal in others on account of differences in legal procedure. There would also be differences in procedure with regard to deaths in which nonpuerperal and puerperal causes were certified jointly, due to variation in medical opinion with regard to the causative importance of the nonpuerperal condition that was concurrent with the pregnancy or childbirth. Many reports in recent years have called attention to the lack of comparability arising from differences in procedure, but none so far has attempted to evaluate the effect of these differences upon the maternal mortality rates.

In order to obtain data that would throw light upon the effect of differences in assignment procedure on the comparability of maternal mortality rates it was planned to send to the bureaus of vital statistics in the principal foreign countries the pertinent information from 1,073 United States death certificates<sup>2</sup> for 1927 on which pregnancy or childbirth was mentioned, with a request that each office mark each death as puerperal or nonpuerperal according to its own method of assignment of cause.

The Bureau of the Census had coded all deaths for 1927 in accordance with the 1920 revision of the International List of Causes of Death and the 1925 Manual of Joint Causes of Death, the latter being used for assigning causes when two or more are reported simultaneously. Of the sample group of 1,073 deaths certified by the attending physician as puerperal, the Bureau of the Census, under the United States rules, assigned 997 (92.9 percent) to the puerperal state and 76 (7.1 percent)<sup>3</sup> to nonpuerperal conditions.

The number and percentage of deaths assigned to each cause rubric included under the puerperal state are shown in table 1 for the 997 puerperal deaths included in the sample and for all puerperal deaths in the United States birth-registration area during 1927. The differences in the percentage of deaths from the various causes in the sample and in the total are unimportant. Statistical test demonstrates that they are

<sup>2</sup> These certificates had been selected at random by the late Dr. W. H. Davis, then Chief Statistician for Vital Statistics, United States Bureau of the Census, from transcripts for the year 1927 on file at that bureau, for the purpose of studying comparability of United States methods with those of England and Wales. Through cooperation with Dr. T. F. Murphy, Chief Statistician for Vital Statistics, United States Bureau of the Census, certificates representing every type included in the total were chosen from this original group and the pertinent information set up in list form. The lists were transmitted to the foreign bureaus of vital statistics, and the original tabulations of the returns were made in the Bureau of the Census.

<sup>3</sup> This percentage (92.9) of the 1,073 deaths associated with pregnancy and childbirth that were assigned to the puerperal state is significantly different from the percentage (90.7) so assigned for the birth-registration area in 1925, the latest year for which the Bureau of the Census has tabulated deaths for the area by both primary and contributory cause. The 1925 percentage, however, is perhaps not representative of the usual situation in the United States. For there is also a significant difference between 1925 and 1927 and between 1925 and 1925-29 in the distribution by cause groups of the deaths within the puerperal state.



COMPARABILITY OF MATERNAL MORTALITY RATES

within the limits of expectation on the basis of chance in the process of drawing the sample from the total group.<sup>4</sup> Therefore the distribution by cause of the 997 deaths assigned to pregnancy and childbirth which are included in this sample is typical of that of all deaths assigned to the puerperal state in the United States birth-registration area during 1927.

TABLE 1.—Distribution of puerperal causes among the deaths included in the sample and among all puerperal deaths in the United States birth-registration area; 1927

Cause of death <sup>1</sup>	Sample		United States birth-registration area <sup>2</sup>	
	Number	Percent distribution	Number	Percent distribution
Total.....	1,073			
The puerperal state.....	997	100.0	13,837	100.0
Accidents of pregnancy.....	92	9.2	1,259	9.1
Puerperal hemorrhage.....	115	11.5	1,456	10.5
Other accidents of labor.....	109	10.9	1,542	11.1
Puerperal septicemia.....	392	39.3	5,353	38.7
Puerperal phlegmasia alba dolens, embolus, sudden death.....	60	6.0	615	4.4
Puerperal albuminuria and convulsions.....	226	22.7	3,556	25.7
Following childbirth (not otherwise defined).....	3	0.3	48	0.3
Puerperal diseases of the breast.....			8	0.1
Nonpuerperal causes.....	76			

<sup>1</sup> According to the International List of Causes of Death, 1920.

<sup>2</sup> U. S. Bureau of the Census.

Among the 1,073 certificates included in the sample were many that were identical or very similar. For transmittal to foreign countries, therefore, 477 certificates were carefully selected so as to include at least 1 death of every type in the sample. For some of these 477 deaths only 1 cause had been certified, as puerperal sepsis or eclampsia or self-induced abortion, but for by far the greater proportion 2 or even 3 causes were mentioned by the physician who made out the certificate.

The information from the 477 certificates, set up in list form with each line representing one death (see sample, p. 4), consisted of the case number, age of mother, primary and contributory cause of death, and performance or nonperformance of an operation and of an autopsy. At the right two blank columns were provided. It was asked that the first of these columns be checked if the death would be classed as puerperal and the second if it would be classed as nonpuerperal by the statistical bureau in charge of coding cause of death in each country. No information was given with regard to the cause assigned in the United States. These lists were sent to 24 foreign countries during January 1931, and were checked and returned by 16 countries by the middle of April of the same year.

<sup>4</sup> The similarity of the distributions has been determined by the chi-square test developed by Pearson:  $\chi^2=10.51, P=0.11$ . For formula and method see: Tables for Statisticians and Biometricians, edited by Karl Pearson, pp. xxxi-xxxiii (Cambridge University Press, London, 1914).

Sample page of list sent abroad

COMPARABILITY OF MATERNAL MORTALITY RATES

No.	Age (yrs.)	Cause of death		Operation	Autopsy	Puerperal	Nonpuerperal
		Primary	Contributory (secondary)				
15	31	Incomplete abortion, secondary anemia (5 weeks).....	Bronchopneumonia (5 days).....	Yes....	Yes....		
16	33	Embolus to lung causing an infarct (1 day).....	Puerperal streptococcic salpingitis.....	Yes....	No....		
17	26	Edema of lungs, acute and chronic myocarditis.....	Pregnancy (8 months).....				
18	23	Acute salpingitis, Cesarean operation (9 days).....	Internal hemorrhage (2½ hours).....				
19	18	Chronic pulmonary tuberculosis.....	Pregnancy and labor.....				
20	39	Myocardial failure during operation for lacerated perineum and uterine fibroma. Recent childbirth.		Yes....			
(4) 21	40	Peritonitis (puerperal) (4 days).....	Diabetes mellitus (5 years).....	Yes....	No....		
22	23	Diffuse peritonitis.....	Puerperal salpingitis.....	Yes....	Yes....		
23	41	Bronchopneumonia.....	Miscarriage, pulmonary embolism.....	Yes....	Yes....		
24	22	Hyperemesis gravida. Therapeutic abortion.....	Chronic interstitial nephritis.....				
25	26	Pulmonary embolism.....	Pregnancy and myocarditis.....				
26	40	Peritonitis (general), Cesarean section, prolonged labor (2 days).	Myocarditis.....	Yes....			

## COMPARABILITY OF MATERNAL MORTALITY RATES

Upon the return of the lists the 596 deaths in the original group not sent abroad but identical with those sent were classed as puerperal or nonpuerperal in accordance with the assignments made by the foreign countries for those that had been transmitted. The groups of deaths were then thrown together, and a tabulation of the 1,073 certificates was prepared showing the assignment of the United States Bureau of the Census and the classification as puerperal or nonpuerperal by each foreign bureau that complied with the request.

### *Proportion of Deaths Assigned to Puerperal and Nonpuerperal Causes by the Different Countries*

Table 2 shows the number of deaths classified as puerperal and as nonpuerperal by the United States and by each country that furnished information. No decision was reached by some countries with regard to the classification of a few of the deaths, as under their procedure more information would have been required before the classification could be determined.

As has been noted, the United States had assigned to the puerperal state 997 (92.9 percent) of the 1,073 deaths associated with pregnancy and childbirth. Denmark, the only country that would have so assigned more deaths than the United States, classified 1,054 (99.4 percent) as puerperal. Norway would have assigned the fewest, 825 (76.9 percent), and England and Wales came next to Norway with 844 (78.7 percent). The proportion of deaths assigned to nonpuerperal causes varied from 23.1 percent for Norway to six-tenths of 1 percent for Denmark.

The proportions (in the United States) assigned to puerperal causes (92.9 percent) and to nonpuerperal causes (7.1 percent) are not significantly different from those for Australia, the Netherlands, New Zealand, and Scotland.<sup>5</sup> These countries must be considered to have made assignments in approximately the same ratio to puerperal and nonpuerperal causes as the United States. Italy, Canada, Chile, Czechoslovakia, Northern Ireland, France, Irish Free State, Sweden, Estonia, England

<sup>5</sup> The probable errors of the respective percentages have been computed by the formula

$$P. E. = 0.6745 \sqrt{\frac{\text{percent} \times (100 - \text{percent})}{\text{Number in sample}}}$$

The probable error of the difference of two percentages, by the formula:

$$P. E. \text{ of diff.} = \sqrt{(P. E. \text{ of U. S. percentage})^2 + (P. E. \text{ of specified country})^2}$$

A difference between percentages is considered significant whenever it exceeds 3 times its probable error.

COMPARABILITY OF MATERNAL MORTALITY RATES

and Wales, and Norway, on the other hand, assigned significantly more to nonpuerperal and significantly less to puerperal causes than the United States.

Of the 4 countries which assigned the deaths to puerperal and nonpuerperal causes in approximately the same ratio as the United States, 3 (Australia, New Zealand, and the Netherlands) have officially adopted the United States Manual of Joint Causes of Death, and the fourth, Scotland, uses this manual, although it has never adopted it officially. Canada uses the United States Manual of Joint Causes to supplement the English rules whenever the latter do not seem to apply.<sup>6</sup> The percentage of deaths assigned to puerperal causes by the Canadian office (89.6) is more similar to that of the United States (92.9) than to that of England and Wales (78.7).

TABLE 2.—Assignment to puerperal and nonpuerperal causes by the United States and certain foreign countries<sup>1</sup> of 1,073 deaths associated with pregnancy and childbirth that occurred in the United States during 1927

Country	Total	Puerperal causes		Nonpuerperal causes		Not classified
		Number	Percent <sup>2</sup>	Number	Percent <sup>2</sup>	
United States.....	1,073	997	92.9	76	7.1	-----
Australia <sup>3</sup> .....	1,073	995	92.7	78	7.3	-----
Canada.....	1,073	953	89.6	111	10.4	-----
Chile.....	1,073	950	88.6	122	11.4	-----
Czechoslovakia.....	1,073	899	85.3	155	14.7	-----
Denmark.....	1,073	1,054	99.4	6	.6	-----
England and Wales.....	1,073	844	78.7	229	21.3	-----
Estonia.....	1,073	857	79.9	215	20.1	-----
France.....	1,073	884	82.7	185	17.3	-----
Irish Free State.....	1,073	869	81.0	204	19.0	-----
Italy.....	1,073	971	90.5	102	9.5	-----
Netherlands <sup>3</sup> .....	1,073	986	91.9	87	8.1	-----
New Zealand <sup>3</sup> .....	1,073	996	92.8	77	7.2	-----
Northern Ireland.....	1,073	899	83.9	173	16.1	-----
Norway.....	1,073	825	76.9	248	23.1	-----
Scotland <sup>3</sup> .....	1,073	989	92.3	83	7.7	-----
Sweden.....	1,073	864	80.5	209	19.5	-----

<sup>1</sup> Countries to which lists were sent but from which no returns were received were Belgium, Finland, Hungary, Japan, Lithuania, Salvador, Switzerland, and Uruguay.

<sup>2</sup> Based on total deaths classified.

<sup>3</sup> Percentages assigned not significantly different from those of the United States.

With regard to the assignment by the Danish office of 99.4 percent to the puerperal group and 0.6 percent to the nonpuerperal, it should be noted that the deaths were assigned in 1931 and that several changes have been made in the last few years in the Danish classification of cause of death. The statistical reports for Denmark published annually by the National Health Service (Dødsarsagerne i Kongeriget Danmark) show that in 1928 and earlier the Danish nomenclature included only two types of puerperal causes: "Febris puerperalis" and "In aut brevi

<sup>6</sup> Macphail, E. S.: Rules for Choice of Causes of Death in the Dominion Bureau of Statistics. Canadian Public Health Journal, vol. 24, no. 9 (Sept. 1933), pp. 413-419.

## COMPARABILITY OF MATERNAL MORTALITY RATES

postpartum mort. (Fb. puerp. excl.)” In 1929, however, the inclusion was broadened and the number of titles was increased; and the nomenclature used in 1930 and 1931 shows even more detail for the puerperal state than the latest revision of the international list (1929).

This development of the nomenclature of Denmark is no doubt due, at least in part, to the interest in comparability that has become widespread in recent years. The stimulus was probably brought to a focus by the Committee on Maternal Mortality and Morbidity of the British Ministry of Health, which has made a special investigation of the comparability of the statistical aspects of Danish and English maternal mortality.<sup>7</sup>

TABLE 3.—*Assignment to puerperal and nonpuerperal causes; deaths associated with pregnancy and childbirth that occurred in the United States and in six foreign countries<sup>1</sup> and deaths included in the United States sample<sup>2</sup> classified according to the methods of these countries*

Country	Percentage of deaths associated with pregnancy and childbirth—			
	Occurring in the respective countries <sup>1</sup> assigned to—		Included in the United States sample assigned to—	
	Puerperal causes	Nonpuerperal causes	Puerperal causes	Nonpuerperal causes
United States.....	90.9	9.1	92.9	7.1
Canada.....	85.1	14.9	89.6	10.4
England and Wales.....	77.8	22.2	78.7	21.3
Irish Free State.....	91.3	8.7	81.0	19.0
New Zealand.....	94.7	5.3	92.8	7.2
Northern Ireland.....	81.7	18.3	83.9	16.1
Scotland.....	81.7	18.3	92.3	7.7

<sup>1</sup> Figures for the United States are for 1925, the latest year for which the Bureau of the Census has tabulated deaths by both primary and contributory cause; those for foreign countries are for the following periods: Canada, 1925-31; England and Wales and New Zealand, 1925-30; Irish Free State and Northern Ireland, 1925-32; Scotland, 1931-32.

<sup>2</sup> 1,073 deaths that occurred in the United States during 1927.

In connection with the classification of the 1,073 deaths in the sample, it is of interest to examine the percentages of their own deaths associated with pregnancy and childbirth which the countries assign to puerperal causes. Table 3 presents this information for the six foreign countries that publish the basic material and for the United States, and also the percentages of the United States sample assigned to puerperal causes by these countries. The Irish Free State assigned to puerperal causes a larger proportion of its own maternal deaths than of the sample; Canada and Scotland assigned a smaller proportion; and New Zealand, England and Wales, and Northern Ireland assigned approximately the same proportions of their own deaths and of the sample. This suggests that the various types of nonpuerperal causes may be certified in approxi-

<sup>7</sup> Final report of Departmental Committee on Maternal Mortality and Morbidity. Great Britain Ministry of Health. London, 1932.

mately the same proportion as that of the United States, in the countries which assign to the puerperal state approximately the same percentage of their own deaths and of the sample and that these types may be certified in a somewhat different proportion from that of the United States in countries which assign to the puerperal state different percentages of their own deaths and of the sample. The differences in the percentage of the sample and of their own deaths assigned in the various countries to nonpuerperal causes indicate either differences in frequency of occurrence of the causative diseases and conditions or differences in the completeness with which physicians certifying cause of death describe the morbid conditions.

*Differences in Methods of Assignment to Puerperal  
and Nonpuerperal Causes in the  
Different Countries*

The number of death certificates (477) in the group sent abroad was too small to warrant final conclusions regarding the assignment procedures of the countries from which returns were received. However, study of these certificates in connection with the correspondence that accompanied them upon their return and with examination of available manuals for assigning cause of death, and study of tables showing maternal deaths by both primary and contributory cause that are published by a few countries in their annual reports, demonstrate that real differences in procedure exist. Infectious diseases resulting in high mortality, such as pneumonia and influenza, are almost invariably given precedence by certain countries, whereas in other countries they are given precedence only when the onset followed normal delivery or when there was no evidence that an abortion would have occurred or that pregnancy would have terminated other than normally, except for the intercurrent disease. Heart conditions are given precedence more frequently by some countries than by others. Pulmonary tuberculosis existing prior to the pregnancy was generally considered a primary cause, but some countries favor the puerperal condition. Acute nephritis is considered by most countries merely another name for puerperal albuminuria and convulsions but by some as a distinct disease in which destruction of the functional tissue of the kidney is primarily responsible for the death. One country, in contrast to all others, assigns embolism, even when specified to be puerperal, to the nonpuerperal class. All countries include the majority of the deaths from abortion, but abortions induced by "self or party unknown" are excluded by several countries; and one small country, which recently adopted the international classification of causes of death, places abortions due to accidents in the nonpuerperal class.

The United States Manual of Joint Causes of Death, previously stated to be used by the United States, Australia, New Zealand, Scotland, and

the Netherlands, and also by Canada whenever the English rules do not seem to apply (p. 6), designates in great detail the cause to which the death should be assigned when two or more causes are certified jointly. In England and Wales<sup>8</sup> and in Italy<sup>9</sup> much effort is directed toward facilitating an expression of opinion by the certifying practitioner as to which of two or more causes is the primary cause of death. General rules for precedence are in use in the statistical offices, but it is considered desirable that the selection of the primary cause should be determined in the main by the opinion of the certifier rather than by rigid rules. In Sweden, at the other extreme from the United States, the doctor's certification as to the main cause is usually taken as correct.<sup>10</sup>

The differences in methods of assignment just discussed usually resulted in charging to the nonpuerperal class certificates classified in the United States as puerperal. Certain combinations of joint causes assigned in this country to the nonpuerperal group, however, were frequently assigned by other countries to the puerperal state.

*Maternal Mortality Rates That Would Have Obtained in the  
United States under Methods of Assignment  
of Various Foreign Countries*

Table 4 shows the total number of deaths in the sample that were assigned to the puerperal state and the number assigned to sepsis and other puerperal causes in the United States, the number that would have been so assigned by each foreign country under its assignment procedure, and the percentage change that would have obtained in the United States under the assignment procedure of each of the foreign countries. In this connection it should be called to mind that the foreign offices were not asked to specify the type of puerperal cause to which the death would be assigned. Sepsis, however, generally has preference over other types of puerperal causes, and the deaths that were considered puerperal generally would have been assigned to the sepsis rubric whenever that cause was mentioned and to other puerperal causes when there was no mention of a septic condition.

Since the puerperal-cause distribution of the deaths included in the sample was typical of that of all deaths of the year 1927 assigned by the

<sup>8</sup> Manual of the International List of Causes of Death, as adapted for use in England and Wales, Scotland, and Northern Ireland, pp. vi-viii. Registrar General, London, 1931.

<sup>9</sup> Nomenclature Nosologique per la Statistica delle Cause di Morte e Dizionario delle Malattie, p. 58. Istituto Centrale di Statistica del Regno d'Italia. Rome, 1933.

<sup>10</sup> Hultquist, Gustaf: Några Anmärkingar till Vår Nya Dödsorsaksstatistik. Allmänna Svenska Läkartidningen, 11th year, no. 51 (Dec. 18, 1914), p. 1179. See also Final Report of Departmental Committee on Maternal Mortality and Morbidity, p. 85 (Great Britain Ministry of Health, London, 1932).

COMPARABILITY OF MATERNAL MORTALITY RATES

Bureau of the Census to the puerperal state, the proportions of the sample classed as "puerperal" under the methods of assignment of the different countries indicate the variations that would have occurred had all the deaths of that year associated with pregnancy and childbirth been transmitted for assignment. On the basis of the percentage changes shown in table 4 therefore it is legitimate to estimate the total deaths in the United States in 1927 that would have been assigned to puerperal causes by each foreign country and to compute the maternal mortality rates that would have obtained in this country under the assignment procedure of the various foreign offices.

TABLE 4.—Percentage change that would have obtained in the mortality due to puerperal causes in the United States under the assignment procedure of the different countries

Country	The puerperal state		Puerperal septicemia		All other puerperal causes	
	Number of deaths	Percent of change	Number of deaths	Percent of change	Number of deaths	Percent of change
United States.....	997		392		605	
Australia.....	995	-0.2	388	-1.0	607	+0.3
Canada.....	953	-4.4	378	-3.6	575	-5.0
Chile.....	950	-4.7	382	-2.6	568	-6.1
Czechoslovakia.....	899	-9.8	370	-5.6	529	-12.6
Denmark.....	1,054	+5.7	393	+0.3	661	+9.3
England and Wales.....	844	-15.3	338	-13.8	506	-16.4
Estonia.....	857	-14.0	311	-20.7	546	-9.8
France.....	884	-11.3	367	-6.4	517	-14.5
Irish Free State.....	869	-12.8	328	-16.3	541	-10.6
Italy.....	971	-2.6	386	-1.5	585	-3.3
Netherlands.....	986	-1.1	389	-0.8	597	-1.3
New Zealand.....	996	-0.1	387	-1.3	609	+0.7
Northern Ireland.....	899	-9.8	374	-4.6	525	-13.2
Norway.....	825	-17.3	364	-7.1	461	-23.8
Scotland.....	98	-0.8	390	-0.5	599	-1.0
Sweden.....	864	-13.3	364	-7.1	500	-17.4

Because of the variation that occurs in the different countries in certification of cause as well as the possible differences in the relative frequency of the occurrence of the various diseases in connection with deaths assigned to pregnancy and childbirth, the effects of the similarities and differences in assignment procedure are measurable only in terms of what the United States rate would have been had its deaths been classified in the foreign bureaus of vital statistics. The rates thus obtained for the United States may, of course, be compared with the rates of the countries themselves.

Table 5 shows the actual rates of the United States from deaths assigned to the puerperal state and from puerperal sepsis and other puerperal causes, and estimated rates for the United States based on the assignment methods of each of the foreign offices. In juxtaposition to these estimated rates for the United States the actual rates of the foreign countries are shown. For each country except France the official rate is computed on the basis of total live births. The French rate is based on the total



COMPARABILITY OF MATERNAL MORTALITY RATES

births of infants reported as living at the time of registration, but is not significantly different from the rate that would result from using total live births.<sup>11</sup> The differences between the estimated rates for the United States based on the foreign methods of assignment and the rates of the foreign countries themselves must be considered as representative of real differences in mortality arising from variation in such factors as social and economic conditions, racial and physiological types, general public health, community provision for maternal welfare, and obstetric practice.

TABLE 5.—Maternal mortality rates that would have obtained in the United States under the methods of assignment of certain foreign countries and the official rates of these countries; 1927

Country	Deaths assigned to the puerperal state per 10,000 live births					
	Total		Puerperal septicemia		All other puerperal causes	
	Rate of United States under method of assignment of specified foreign country <sup>1</sup>	Official rate of country <sup>2</sup>	Rate of United States under method of assignment of specified foreign country <sup>1</sup>	Official rate of country <sup>2</sup>	Rate of United States under method of assignment of specified foreign country <sup>1</sup>	Official rate of country <sup>2</sup>
United States.....		64.7		25.0		39.7
Australia.....	<sup>3</sup> 64.6	59.2	<sup>3</sup> 24.8	21.5	<sup>3</sup> 39.8	37.7
Canada.....	61.9	55.5	24.1	19.1	37.7	36.4
Chile.....	61.7	57.7	24.4	19.6	37.3	38.1
Czechoslovakia.....	58.4	35.8	23.6	19.7	34.7	16.0
Denmark.....	68.4	<sup>4</sup> 40.5	25.1	<sup>4</sup> 12.6	43.4	<sup>4</sup> 27.9
England and Wales.....	54.8	41.1	21.6	15.7	33.2	25.4
Estonia.....	55.6	41.1	19.8	8.6	35.8	32.5
France.....	57.4	<sup>5</sup> 28.7	23.4	<sup>5</sup> 11.4	33.9	<sup>5</sup> 17.3
Irish Free State.....	56.4	45.1	20.9	12.8	35.5	32.3
Italy.....	63.0	26.4	24.6	9.1	38.4	17.4
Netherlands.....	<sup>3</sup> 64.0	29.0	<sup>3</sup> 24.8	8.9	<sup>3</sup> 39.2	20.0
New Zealand.....	<sup>3</sup> 64.6	49.1	<sup>3</sup> 24.7	25.1	<sup>3</sup> 40.0	24.0
Northern Ireland.....	58.4	48.0	23.9	18.0	34.5	30.0
Norway.....	53.5	24.5	23.2	10.2	30.3	14.3
Scotland.....	<sup>3</sup> 64.2	64.3	<sup>3</sup> 24.9	19.0	<sup>3</sup> 39.3	45.3
Sweden.....	56.1	27.8	23.2	12.7	32.8	15.1

<sup>1</sup> Estimate based on sample of 1,073 deaths that occurred in the United States in 1927.

<sup>2</sup> Figures from official sources.

<sup>3</sup> Not significantly different from the United States official rate.

<sup>4</sup> Rate for 1931.

<sup>5</sup> Based on total births reported as live.

The lowest maternal mortality rate for the United States would have occurred if the practice in assignment of cause of death of Norway had

<sup>11</sup> Under the law of France all births must be registered within 3 days, and it must be specified whether the child was alive at date of registration (*présenté vivanti*) or dead at that time (*mort-né*). It is not obligatory to specify whether the mort-nés were born alive or born dead, but space for this information is provided on the certificate, and the information is generally given for statistical use. Every year there are from 3,000 to 4,000 mort-nés for which there is no report as to condition of life at birth. In the rates shown in tables 5 and 7 these births are not included. If all of them were considered born alive—they unquestionably include many still-born fetuses—the total live births would be increased from 0.4 to 0.5 percent annually, and the maternal mortality rates would be decreased at most 0.2 per 10,000.

been used (53.5 per 10,000 live births). If England and Wales had made the assignments, the rate would have been 54.8. These minimums are to be contrasted with the maximum rate (68.4) which would have obtained under the procedure of Denmark, and with the official rate of the United States itself (64.7). The rates that would have obtained for the United States from assignment by countries in which the percentage of deaths associated with pregnancy and childbirth that were assigned to the puerperal state was approximately the same<sup>12</sup> as that of the United States were: Australia, 64.6; New Zealand, 64.6; Scotland, 64.2; and the Netherlands, 64.0.

The rates for the United States if the assignments of cause had been made in accordance with the official practice in the respective foreign offices were, with but one exception (Scotland), in excess of the official figures of the respective countries. Under the procedure of Scotland the United States rate would have been 64.2 and the Scottish rate was 64.3. After adjustment of assignment procedures the United States rates exceeded the official rates of five countries (Norway, Sweden, France, Italy, and the Netherlands) by at least 100 percent.

In discussions of official maternal mortality rates the United States is often referred to as heading the list; that is, having the highest rate. The United States rate under the assignment procedures of Australia, New Zealand, and Denmark would maintain this position with respect to the official rates of those countries. The best position that the United States could have achieved would be fifth from the highest, when its rate is determined under the system of Norway and of England and Wales. (Countries with higher rates would be Scotland, Australia, Chile, and Canada.) Under every system of assignment the United States has a very high maternal mortality rate in comparison with other countries.

The official United States rate from puerperal sepsis was 25.0 per 10,000 live births, a figure in excess of that of every country except New Zealand (25.1). The United States rates from sepsis estimated on the basis of the foreign procedures varied from a minimum of 19.8 per 10,000 live births, which would have obtained if the assignments had been made by Estonia, and 20.9 under the procedure of the Irish Free State, to a maximum of 25.1 under the Danish procedure. The official rates of these countries for deaths from sepsis were 8.6 (Estonia), 12.8 (Irish Free State), and 12.6 (Denmark). The rates are for the same year as the sample, 1927, except that of Denmark, which is for 1931, a year when classification was more nearly similar to that of the United States (see p. 7). The estimates for the United States when the foreign method of classification was used were, in every instance except New Zealand, higher than the official rates of the countries themselves. The adjusted United States

<sup>12</sup> As tested by the method described for significance of differences. See p. 5, footnote 5

rates were more than double the rates of Estonia, France, Italy, the Netherlands, and Norway. Under the procedures of Estonia and the Irish Free State the United States would have stood third from the highest in its maternal mortality rate from sepsis, New Zealand and Australia being higher. Under the assignment procedure of every other country the United States would have had the highest or next to the highest sepsis rate with respect to the official rates of the countries themselves.

The estimated rates for the United States from all other puerperal causes varied from 30.3 based on the procedure of Norway to 43.4 based on the procedure of Denmark, the official rate for the United States being 39.7. In contrast to these rates, the official rates of the foreign countries varied from 14.3 for Norway to 38.1 for Chile and 45.3 for Scotland, the last two being the only countries whose own figures exceed the comparable rates estimated for the United States. Five foreign countries had rates less than 20, nine had rates less than 30 per 10,000 live births. The official United States rate is next to the highest. If the deaths had been assigned by the procedure of Norway, which affords the minimum estimate, the United States would have been seventh in the list as compared with the official rates of the foreign countries.

*Comparison of the United States Rate for Deaths Assigned to the Puerperal State with Those for All Deaths Associated with Pregnancy and Childbirth in Six Foreign Countries*

Further evidence that the height of the maternal mortality rates in the United States is not due solely to the method of assignment of cause appears in table 6, which gives for the years 1925-32 the mortality rates from all deaths associated with pregnancy and childbirth in six foreign countries that publish the basic facts, and the United States rates for deaths assigned to puerperal causes. The United States figures of course exclude deaths in which pregnancy or childbirth was mentioned on the death certificate together with a nonpuerperal cause considered primary under the rules, whereas the rates for the foreign countries include all deaths in which pregnancy or childbirth was mentioned on the death certificate. In each year the United States rate for deaths assigned to the puerperal state either exceeded or was approximately the same as those of the other countries for all deaths in connection with which the puerperal state was mentioned, except Canada in 1925 and 1926 and Scotland in 1931 and 1932.

COMPARABILITY OF MATERNAL MORTALITY RATES

TABLE 6.—Mortality rates from deaths assigned to the puerperal state in the United States and from all deaths associated with pregnancy and childbirth in six foreign countries, 1925–32

Country	Deaths associated with pregnancy and childbirth per 10,000 live births <sup>1</sup>							
	1925	1926	1927	1928	1929	1930	1931	1932
United States <sup>2</sup> .....	64.7	65.6	64.7	69.2	69.5	67.3	66.1	63.3
Canada.....	67.5	67.5	64.4	66.0	68.9	66.3	57.9	-----
England and Wales.....	51.5	51.4	54.3	56.2	58.2	55.9	-----	-----
Irish Free State.....	50.3	53.8	48.5	53.7	48.6	50.4	47.6	49.8
New Zealand.....	48.3	45.0	51.6	50.7	53.1	53.7	-----	-----
Northern Ireland.....	54.5	62.1	65.2	65.1	62.6	60.7	65.8	63.7
Scotland.....	-----	-----	-----	-----	-----	-----	72.1	77.7

<sup>1</sup> Figures from official sources.

<sup>2</sup> Figures for the United States exclude deaths associated with pregnancy and childbirth that were assigned to nonpuerperal causes.

*Trend of Maternal Mortality in the United States and Certain Foreign Countries*

The trend of mortality assigned to the puerperal state and to puerperal sepsis and all other puerperal causes as indicated by official figures, is shown in table 7 for the United States expanding birth-registration area, for the years 1925 to 1933 and for each foreign country for the years within this period for which the information is available. It is evident from this table that the rates for the year 1927 are, for most countries, fairly typical of the period. In the United States expanding birth-registration area and in most foreign countries the rates from deaths assigned to the puerperal state have been characterized mainly by fluctuation. In Chile, Czechoslovakia, and Denmark, there have been significantly higher rates in the later years of the period under consideration. The only country showing a significant decrease is Canada where the mortality has been markedly lower since 1931 than in previous years.

In most of the foreign countries births and deaths were registered each year in practically all areas comprised within the political boundaries. The United States birth-registration area, in sharp contrast, included a constantly increasing number of States, expanding from 33 States in 1925 to 48 in 1933. The rates for a constant area of the United States would be much more comparable with the figures for foreign countries than those for the expanding area of the United States. Table 8 shows the mortality rates from the puerperal state and from puerperal sepsis and all other puerperal causes in the 1925 birth-registration area during the years 1925 to 1933. Unlike most foreign countries, this area of the United States had rates from these causes that were considerably lower in 1932 than in 1925. During the period under review fluctuation is of

# COMPARABILITY OF MATERNAL MORTALITY RATES

TABLE 7.—Trend of maternal mortality in the United States and certain foreign countries;  
1925-33

Country	Deaths assigned to pregnancy and childbirth per 10,000 live births <sup>1</sup>								
	925	1926	1927	1928	1929	1930	1931	1932	1933
<b>THE PUERPERAL STATE</b>									
United States <sup>2</sup> .....	64.7	65.6	64.7	69.2	69.5	67.3	66.1	63.3	61.9
Australia.....	56.4	53.0	59.2	59.8	50.8	53.0	54.8	55.7	51.3
Canada.....	56.4	56.6	55.5	56.2	57.0	57.7	50.5	50.2	<sup>3</sup> 49.7
Chile.....	61.1	58.3	57.7	58.6	77.8	67.7	75.0	71.0	-----
Czechoslovakia.....	33.3	34.0	35.8	39.7	42.8	40.7	41.4	<sup>3</sup> 42.8	<sup>3</sup> 48.5
Denmark.....	23.6	26.6	30.6	27.0	31.7	38.3	40.5	35.0	36.5
England and Wales.....	40.8	41.2	41.1	44.2	43.4	44.0	41.1	42.1	<sup>3</sup> 43.2
Estonia.....	38.2	40.5	41.1	50.3	46.0	49.3	42.5	33.9	-----
France <sup>4</sup> .....	23.8	24.4	28.7	29.0	29.3	26.7	24.9	-----	-----
Irish Free State.....	46.9	48.9	45.1	49.3	41.0	47.6	43.1	45.5	-----
Italy.....	28.1	25.5	26.4	28.0	28.8	27.2	27.8	29.8	-----
Netherlands.....	26.3	28.7	29.0	33.6	33.5	33.3	32.0	30.2	<sup>3</sup> 31.6
New Zealand.....	46.5	42.5	49.1	49.3	48.2	50.8	47.7	40.6	44.4
Northern Ireland.....	44.4	56.1	48.0	52.4	49.2	52.9	51.4	53.4	-----
Norway.....	26.8	31.8	24.5	30.3	36.2	30.3	27.0	26.4	-----
Scotland.....	61.6	64.0	64.3	69.8	68.7	69.5	59.1	63.3	59.2
Sweden.....	26.3	29.4	27.8	33.0	37.9	34.8	36.8	26.6	-----
<b>PUERPERAL SEPTICEMIA</b>									
United States <sup>2</sup> .....	24.3	24.2	25.0	25.0	26.4	24.0	24.6	23.0	23.5
Australia.....	17.4	16.4	21.5	20.5	17.1	18.8	21.1	21.9	20.9
Canada.....	16.8	18.6	19.1	18.5	19.6	20.6	18.0	<sup>3</sup> 17.3	<sup>3</sup> 16.7
Chile.....	15.0	15.7	19.6	20.7	33.6	28.1	-----	28.5	-----
Czechoslovakia.....	14.3	13.1	19.7	24.3	23.6	22.6	21.0	<sup>3</sup> 25.2	<sup>3</sup> 26.6
Denmark.....	9.1	10.9	10.5	11.7	10.0	11.8	12.6	10.7	13.1
England and Wales.....	15.6	16.0	15.7	17.9	18.0	19.2	16.6	16.1	<sup>3</sup> 17.5
Estonia.....	3.9	4.0	8.6	10.5	7.3	23.1	13.3	10.1	-----
France <sup>4</sup> .....	9.3	9.7	11.4	11.0	11.6	9.8	8.7	-----	-----
Irish Free State.....	16.9	18.8	12.8	17.4	13.7	13.9	11.6	13.9	-----
Italy.....	10.2	8.4	9.1	9.4	9.2	8.8	10.6	11.7	-----
Netherlands.....	8.6	9.3	8.9	9.4	13.3	11.4	10.2	9.1	<sup>3</sup> 9.4
New Zealand.....	14.9	13.7	25.1	20.6	18.3	21.3	17.7	15.7	16.4
Northern Ireland.....	9.8	17.4	18.0	15.0	14.6	15.1	16.7	15.5	-----
Norway.....	7.8	10.0	10.2	16.2	19.0	14.0	11.1	10.1	-----
Scotland.....	16.4	16.9	19.0	24.2	23.8	23.4	22.6	26.7	24.5
Sweden.....	12.2	16.0	12.7	17.9	20.6	18.6	18.2	<sup>3</sup> 10.1	-----
<b>ALL OTHER PUERPERAL CAUSES</b>									
United States <sup>2</sup> .....	40.4	41.4	39.7	44.2	43.2	43.3	41.5	40.3	38.4
Australia.....	39.0	36.6	37.7	39.3	33.7	34.1	33.8	33.8	30.5
Canada.....	39.6	38.0	36.4	37.7	37.3	37.1	32.5	<sup>3</sup> 32.9	33.1
Chile.....	46.1	42.6	38.1	38.0	44.2	39.6	-----	42.5	-----
Czechoslovakia.....	19.0	21.0	16.0	15.4	19.2	18.2	20.4	<sup>3</sup> 17.6	<sup>3</sup> 21.8
Denmark.....	14.5	15.7	20.1	15.3	21.7	26.5	27.9	24.3	23.4
England and Wales.....	25.2	25.2	25.4	26.3	25.3	24.8	24.5	26.0	<sup>3</sup> 25.7
Estonia.....	34.2	36.5	32.5	39.9	38.7	26.2	29.2	23.8	-----
France <sup>4</sup> .....	14.5	14.7	17.3	18.0	17.7	16.9	16.2	-----	-----
Irish Free State.....	30.0	30.1	32.3	31.9	27.3	33.8	31.5	31.7	-----
Italy.....	17.8	17.1	17.4	18.6	19.6	18.4	17.3	18.0	-----
Netherlands.....	17.8	19.4	20.0	24.1	20.3	22.0	21.8	21.1	<sup>3</sup> 22.2
New Zealand.....	31.6	28.8	24.0	28.7	29.9	29.5	30.1	24.9	27.9
Northern Ireland.....	34.7	38.7	30.0	37.4	34.6	37.9	34.7	37.8	-----
Norway.....	19.1	21.8	14.3	14.0	17.2	16.3	15.9	16.3	-----
Scotland.....	45.2	47.1	45.3	45.7	44.9	46.1	36.5	36.6	34.7
Sweden.....	14.1	13.4	15.1	15.1	17.3	16.2	<sup>3</sup> 16.5	-----	-----

<sup>1</sup> Figures from official sources.

<sup>2</sup> The United States birth-registration area expanded from 33 States in 1925 to 48 States in 1933.

<sup>3</sup> Provisional.

<sup>4</sup> Based on total births reported as live.

## COMPARABILITY OF MATERNAL MORTALITY RATES

course apparent but on the whole an average decrease of about 1 percent per annum <sup>13</sup> is shown in the rates from all deaths assigned to pregnancy and childbirth, in the rates from puerperal sepsis, and in the rates from all other puerperal causes.

TABLE 8.—*Trend of maternal mortality in the United States birth-registration area of 1925; 1925-33*

Cause of death	Deaths assigned to pregnancy and childbirth per 10,000 live births <sup>1</sup>								
	1925	1926	1927	1928	1929	1930	1931	1932	1933
The puerperal state.....	64.7	65.4	62.6	63.8	64.2	62.1	62.2	59.4	58.5
Puerperal septicemia.....	24.3	24.1	24.2	23.3	24.6	22.3	23.8	22.2	22.1
All other puerperal causes.....	40.4	41.3	38.4	40.4	39.6	39.7	38.4	37.3	36.3

<sup>1</sup> Compiled from figures supplied by the U. S. Bureau of the Census.

### *Effect of Differences in Definitions of Live Births and in Completeness of Registration*

In addition to differences in assignment procedure, two other matters are frequently discussed in connection with the comparability of the United States and foreign figures: (1) Differences in definitions of live births and (2) variations in completeness of registration. These are factors of considerable importance, since the total live births registered constitute the divisor in the computation of maternal mortality rates.

The registration of live births is legally compulsory in every country included in the present report except France (see p. 11, footnote 11), where it is only obligatory to report the condition of life at time of registration; but the distinction between live-born and still-born fetuses usually is made on the basis of rules and regulations of the statistical bureau. Two types of definition of stillbirths, and conversely of live births, exist. The Health Committee of the League of Nations has recommended the international adoption of "breathing" as the evidence of life to be used in distinguishing between live births and stillbirths, and this is the definition most frequently used. <sup>14</sup> Most of the statistical offices of the

<sup>13</sup> The average annual rate of change in the rates has been computed by the ordinary formula for geometric progression

$$\log y = a + bx$$

in which  $y$  is the death rate and  $x$  is the time.

<sup>14</sup> See Report of the Committee Studying the Definition of Dead-Birth, in Minutes of Fourth Session, League of Nations Health Committee, pp. 76-80 (Geneva, 1925).

United States and Canada, however, in accord with the rule of the American Public Health Association adopted in 1908 and further developed in 1913, differentiate on the basis of "any evidence of life after complete separation of the child from the body of the mother, evidence of life including action of heart, breathing, movement of voluntary muscle."<sup>15</sup> The differentiation in England and Wales under the Births and Deaths Registration Act of 1926 is similar to that of the United States. Information as to the determining factor is not available for all the foreign countries, but in at least Chile, Czechoslovakia, Denmark, Estonia, Norway, Sweden, and some of the States of Australia, the definition of stillbirth is in the general terms "born without signs of life."<sup>16</sup>

It is of legal and administrative importance to have a clear line of demarcation, and highly desirable from the statistical point of view to have uniformity, not only from State to State but from country to country. The League of Nations Commission of Expert Statisticians has acknowledged, however, that the practice of the United States and of England, although not identical with the commission's recommendation, gives comparable results.<sup>17</sup> The committee on the definition of stillbirth of the American Public Health Association showed by a special study of 1,741 live births in the Boston Lying-in Hospital in 1926 that the use of action of the heart, breathing, movement of voluntary muscle, as compared with breathing alone, as a test of life would increase the number of live births only about four-tenths of 1 percent.<sup>18</sup> Many of the infants who fail to breathe but have heart action or movement of voluntary muscle are already registered as live born in this country, so that the increase in live births would not amount to four-tenths of 1 percent for the United States as a whole. Acceptance by all the States of the American Public Health Association rule and the establishment of uniformity in practice would not lower the maternal mortality rate of

<sup>15</sup> Replies from State officials to a letter asking information regarding the distinction between live births and stillbirths show general accord with the American Public Health Association rule in 36 States and the District of Columbia. In 2 of these States the definition is incorporated in the law, in at least 11 it is printed on the birth certificate, and in 9 others incorporated in the rules of the department or included in the instructions to physicians. Breathing was reported to be the test of life in only 5 States. Replies from 5 of the remaining 7 States for which no information was obtained as to the evidence of life in use stated that no instructions had been issued.

<sup>16</sup> Period of uterogestation enters into the registration of stillbirths but not that of live births. All births of any period are required to be registered if the prescribed signs of life are evidenced by the fetus.

<sup>17</sup> See Report of the Second Session of the Commission of Expert Statisticians, in Minutes of Fourteenth Session, League of Nations Health Committee, pp. 97-103 (Geneva, 1929).

<sup>18</sup> Definition of Stillbirth (report of the American Public Health Association committee to consider the proper definition of stillbirth). American Journal of Public Health, vol. 18, no. 1 (January 1928), pp. 25-32.

this country. The question is evidently not worth serious consideration in connection with comparability.

Completeness of registration is of greater statistical importance in connection with comparability than the line of demarcation between live-born and stillborn infants. Since the registration of live births has been compulsory in most European countries for several generations, and in all, including Estonia, where it was established under the Russian regime, well before the beginning of the twentieth century, it is to be expected that a larger proportion of the births would be registered in these countries than in the United States, where the birth-registration area was not established until 1915. The standard of the United States Bureau of the Census for inclusion in the birth-registration area is that at least 90 percent of the births be registered. In some States, particularly in New England, practically all births are registered, just as in Europe, but in most States registration is at least partly defective. No official figures have been issued regarding completeness in this country, but it is certainly in excess of the minimum standard—somewhere between 90 and the ideal 100 percent.<sup>19</sup>

The effect of incompleteness of birth registration upon the comparability of maternal mortality rates may be gaged by postulating first that birth registration was only 95 percent complete in 1927 and estimating a rate that would obtain if completeness were raised to 100, and second, by postulating 90 percent completeness in 1927 and making a similar estimate. The official rate for 1927 was 64.7 per 10,000 live births. Adjustment on the hypothesis of 95 percent completeness lowers the rate to 61.5, and adjustment on the basis of 90 percent completeness lowers it to 58.3. The difference between the official figure and the adjustment on the basis of 90 percent completeness (6.4 points) represents the maximum possible excess in the official rate arising from incompleteness of birth registration. The actual excess is probably less. Both estimates show that defective birth registration is inadequate to explain more than a few points of the maternal mortality rate. Under either postulate the United States would retain a position near the top of the list of countries. The degree of incompleteness of birth registration existing in this country is evidently not a matter of great importance in connection with the comparability of maternal mortality rates.

<sup>19</sup> Birth registration in the 1927 area was probably about 94 percent complete in 1930. This is estimated on the basis of figures given in *The Completeness of Birth Registration in the United States*, by P. K. Whelpton, in the *Journal of the American Statistical Association*, vol. 29, no. 186 (June 1934), pp. 125-136.



## SUMMARY AND CONCLUSIONS

This study of the comparability of maternal mortality rates of the United States and foreign countries is based on 1,073 deaths associated with pregnancy and childbirth that occurred during the year 1927, including 997 deaths assigned to the puerperal state and 76 deaths assigned to nonpuerperal causes by the United States Bureau of the Census. The distribution by cause of the 997 deaths was similar to that of all deaths in 1927 assigned to the puerperal state. The sample is, therefore, representative of the deaths so classified in the United States during the year. Information in regard to 477 deaths that included one of every type and one of every combination of circumstances represented in the sample 1,073 was sent abroad, and the deaths were classified as puerperal or nonpuerperal by the statistical offices in charge of classification of cause of death of 16 foreign countries in accordance with the rules in force in these offices. The countries making the assignments were: Australia, Canada, Chile, Czechoslovakia, Denmark, England and Wales, Estonia, France, Irish Free State, Italy, Netherlands, New Zealand, Northern Ireland, Norway, Scotland, and Sweden.

In addition to this material, the study is based on information obtained from the manuals for assigning cause of death and the official reports of the statistical bureaus of the various countries, the reports of the Health Committee of the League of Nations and of the Committee on Definition of Stillbirth of the American Public Health Association, and special studies of maternal mortality made by the British Ministry of Health and by individual investigators.

The findings are particularly applicable to 1927, since the deaths included occurred during that year; but since the assignments were made in the spring of 1931, and a great deal of interpretative information has been brought together from other sources, the findings are believed to be indicative of the general situation with regard to comparability, not only for 1927 but also for the years preceding and immediately following the adoption of the 1929 revision of the international classification of cause of death. Unless radical changes have been made very recently with regard to which no information is available they are indicative of the situation at the present time.

The study shows: First: That the methods of assignment in use in Australia, Netherlands, New Zealand, and Scotland are similar to that of the United States, and the official maternal mortality rates are directly

## COMPARABILITY OF MATERNAL MORTALITY RATES

comparable within a small margin of error; that under the method of Denmark a larger number of deaths would be assigned to the puerperal state and the rate for the United States would be significantly higher than it is now; that under the methods of the other countries included in the study—Canada, Chile, Czechoslovakia, England and Wales, Estonia, France, Irish Free State, Italy, Northern Ireland, Norway, and Sweden—a smaller number of deaths would be assigned to the puerperal state and the rates for the United States would consequently be somewhat lower. Second: That differences in methods of assignment are insufficient to explain the high maternal mortality rate of the United States as compared with foreign countries. The official figure of the United States, which in the last few years has exceeded that of every country except Scotland, remains high no matter what method of assignment is used. Even if the method of the country assigning the smallest proportion of deaths to the puerperal state were in use in the United States, the United States figure would still exceed that of all the countries except Australia, Canada, Chile, and Scotland. Rates for the United States estimated in accordance with the assignment procedure of the respective countries are in every instance except Scotland in excess of and are in five instances more than double the official rates of the countries themselves. No matter what method of procedure is used the United States retains an exceedingly high rate as compared with other countries.

Difference in definition of live births is shown to have a negligible effect upon maternal mortality rates. Incompleteness of birth registration has more weight, but it, too, is insufficient to account for more than a few points of the excess of the United States rate over those of most foreign countries. Neither factor is of great importance in connection with comparability.

## RECOMMENDATIONS

1. It would be desirable for the United States Bureau of the Census to publish annually a table showing deaths associated with pregnancy and childbirth by primary and contributory cause and also a table showing deaths associated with pregnancy and childbirth by States, by color, in urban and in rural districts in the States.

2. An investigation of the differences in assignment procedure and the formulation of rules uniformly acceptable to important countries should be undertaken by the International Statistical Institute at an early date.

International uniformity in assignment procedure is the first goal. This uniformity is an essential basis for reliable statistical judgment as to the comparative effect upon maternal mortality of such factors as geographical conditions, physiological characteristics, socio-economic factors, obstetric practice, and community health provision.

## LIST OF REFERENCES

*General References*

- Definition of Stillbirth:** Report of the Committee to Consider the Proper Definition of Stillbirth, American Public Health Association. *American Journal of Public Health*, vol. 28, no. 1 (January 1928), pp. 25-32.
- Dudfield, Reginald:** Stillbirths in Relation to Infantile Mortality. *Journal of the Royal Statistical Society*, vol. 76, part 1 (December 1912), pp. 1-16.
- Great Britain. Ministry of Health:** Interim Report of Departmental Committee on Maternal Mortality and Morbidity. London, 1930. 151 pp.
- : Final Report of Departmental Committee on Maternal Mortality and Morbidity. London, 1932. 156 pp.
- Hultquist, Gustaf:** Några Anmärkningar till Vår Nya Dödsorsaksstatistik. *Allmänna Svenska Läkartidningen*, eleventh year, no. 51 (Dec. 18, 1914), p. 1179.
- Kerr, J. M. Munro:** Maternal Mortality and Morbidity; a study of their problems. E. & S. Livingstone, Edinburgh, 1933. 382 pp.
- League of Nations. Health Committee:** Minutes, 1924-1931.
- Macphail, E. S.:** Rules for Choice of Causes of Death in the Dominion Bureau of Statistics. *Canadian Public Health Journal*, vol. 24, no. 9 (September 1933), pp. 413-419.
- Pearson, Karl, ed.:** Tables for Statisticians and Biometricians. Cambridge University Press, London, 1914. 143 pp.
- Renseignements sur l'Organisation Actuelle des Statistiques de l'État Civil dans Divers Pays.** Office Permanent de l'Institut International de Statistique, The Hague, 1929. 73 pp.
- U. S. Department of Labor. Children's Bureau:** Maternal Mortality; the risk of death in childbirth and from all diseases caused by pregnancy and confinement, by Robert Morse Woodbury. Publication No. 158. Washington, 1926. 163 pp.
- Whelpton, P. K.:** The Completeness of Birth Registration in the United States. *Journal of the American Statistical Association*, vol. 29, no. 186 (June 1934), pp. 125-136.

*Manuals of Causes of Death*

- Australia. Commonwealth Bureau of Census and Statistics:** The Nomenclature of Diseases and Causes of Death as Revised and Adopted in 1900 by the International Commission, together with a Guide for Tabulation in Cases Where More than One Cause of Death Is Assigned. Melbourne, 1907. 93 pp.
- France. Ministère des Affaires Étrangères:** Nomenclatures Internationales des Maladies et des Causes de Décès devant servir à l'établissement des Statistiques Nosologiques arrêtées par la Commission internationale chargée de la revision decennale dans sa troisième session 1920. Paris, 1921. 77 pp.
- Great Britain. Registrar General:** Manual of the International List of Causes of Death as Adapted for Use in England and Wales, Scotland, and Northern Ireland. Based on the Fourth Decennial Revision by the International Commission. London, 1931. 146 pp.

**Italy. Istituto Centrale di Statistica del Regno d'Italia:** Nomenclature Nosologiche per la Statistica delle Cause di Morte e Dizionario delle Malattie. Precedeno: cenni sommari sulle disposizioni relative alle denunce delle cause di morte e delle malattie infettive. Fourth edition, Rome, 1933. 274 pp.

**United States. Department of Commerce. Bureau of the Census:** Manual of the International List of Causes of Death. Third revision, 1920. Washington, 1924. 302 pp.

———. ———. ———: Manual of the International List of Causes of Death. Fourth revision, 1929. Washington, 1931. 342 pp.

———. ———. ———: Manual of Joint Causes of Death Showing Assignment to the preferred Title of the International List of Causes of Death When Two Causes Are Simultaneously Reported. Second edition. Washington, 1925. 209 pp.

———. ———. ———: Manual of Joint Causes of Death Showing Assignment to the Preferred Title of the International List of Causes of Death when Two Causes are Simultaneously Reported. Third edition. Washington, 1933. 255 pp.

### *Official Statistical Reports*

**Australia. Commonwealth Bureau of Census and Statistics:** Australian Demography. Bulletins 43 to 51, 1925 to 1933. Canberra.

**Canada. Dominion Bureau of Statistics:** Vital Statistics, 1925 to 1933. Ottawa.

**Chile. Dirección General de Estadística:** Anuario Estadístico de la República de Chile, Demografía, 1925, 1926; Estadística Anual de la República de Chile, Demografía, 1927; Estadística Anual de la República de Chile, Demografía y Beneficencia, 1928; Estadística Anual, Demografía y Asistencia Social, 1929, 1930, 1932; Estadística Chilena, monthly bulletins, 1931. Santiago de Chile.

**Czechoslovak Republic. Státní Úřad Statistický:** Mitteilungen des Statistischen Staatsamtes der Čechoslovakischen Republik, 1926 to 1932. Prague.

———. ———: Annuaire Statistique de la République Tchecoslovaque, 1934. Prague.

**Denmark. Sundhedsstyrelsen:** Dødsårsagerne i Kongeriget Danmark, 1925 to 1933. Copenhagen.

**England and Wales. Registrar General [Great Britain]:** Registrar-General's Statistical Review of England and Wales, part I, 1925 to 1932. London.

**Estonia. Riigi Statistika Keskbüroo:** Eesti Statistika Kuukiri (Recueil Mensuel du Bureau Central Statistique de l'Estonie), December 1930; February 1932; January 1933; February 1934. Tallinn.

**France. Bureau de la Statistique Générale:** Statistique Générale de la France, Statistique du Mouvement de la Population, Nouvelle Série, 1925 to 1931; Annuaire Statistique, 1927 to 1932. Paris.

**Irish Free State. General Register Office:** Annual Report of the Registrar-General, Saorstat Eireann, 1931, 1932. Dublin.

**Italy. Istituto Centrale di Statistica del Regno d'Italia:** Statistica delle Cause di Morte, 1926. Rome.

———. ———.: Annuario Statistico Italiano. Terza Serie, 1928, 1933; Quarta Serie, 1934. Rome.

**Netherlands. Centraal Bureau voor de Statistiek:** Jaarcijfers voor Nederland (Annuaire Statistique des Pays-Bas), 1929 to 1933. The Hague.

———. ———: Statistiek van de Sterfte naar den Leeftijd en naar de Oorzaken van den Dood, 1925 to 1932. The Hague.

COMPARABILITY OF MATERNAL MORTALITY RATES

**New Zealand. Census and Statistics Office:** Report on the Vital Statistics of the Dominion of New Zealand, 1925 to 1933. Wellington.

**Northern Ireland. Ministry of Finance. Registrar-General's Division:** Registrar-General's Annual Report for 1932. Belfast.

**Norway. Statistiske Centralbyrå:** Statistisk Årbok for Kongeriket Norge (Annuaire Statistique de la Norvège) 1934: Sundhetstilstanden og Medisinalforholdene, Norges Offisielle Statistikk, 1925 to 1931. Oslo.

**Scotland. General Register House:** Annual Report of the Registrar-General for Scotland, 1933. Edinburgh.

**Sweden. Statistiska Centralbyrån:** Statistisk Årsbok för Sverige (Annuaire Statistique de la Suède ) 1933; Dödsorsaker, Sveriges Officiella Statistik, 1925 to 1931. Stockholm.

**United States. Department of Commerce. Bureau of the Census:** Mortality Statistics. Annual Reports 1925 to 1930. Unpublished figures 1931 to 1933. Washington.

—————: Birth, Stillbirth, and Infant Mortality Statistics. Annual Reports 1925 to 1930. Unpublished figures 1931 to 1933. Washington.

(24)



9209  
9209