MATERNAL MORTALITY IN MASSACHUSETTS

A STUDY OF NINE HUNDRED AND EIGHTY-FOUR DEATHS IN THE PUERPERAL STATE *

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This paper is intended to give the results of a study of all the deaths occurring in Massachusetts during the years 1922 and 1923 among women six months or more pregnant, from causes immediately related to pregnancy or childbirth, or from causes in which pregnancy or childbirth was a controlling factor. Certain facts should be emphasized at the beginning.

1. This paper is not intended as a general discussion of mortality in the puerperal state, though it is hoped that the facts presented will be useful as a source of information on which such a discussion could be based in part.

2. No attempt is made to compute mortality rates from these figures. They are not complete, since deaths of women dying before the sixth month of gestation are not included and since deaths occurring after one month post partum are excluded. It was found impos-

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* This is only a preliminary study and certain other more intensive studies are in progress, based on the material used here. These studies will include topics such as septicemia and toxemia, primiparas and operative delivery other than cesarean section. Certain other partial studies already have been completed and published in the Commonhealth, the quarterly magazine of the Massachusetts Department of Public Health. These have included "Statistical Study of One Hundred Cesarean Sections"; "One Hundred Sudden Deaths," and "Review of Maternal Mortality in Massachusetts in 1922."

sible to approach accuracy with respect to the deaths occurring early in pregnancy; hence, the exclusion of such deaths from our figures.

3. The figures are not comparable to the official figures published by the state registrar of vital statistics who, of necessity, is confined to the returns given on the death certificates. Our figures are based on an intensive study of the facts gained not only from the death certificates but also from personal conferences with the attending physicians and hospital authorities, and in some cases, with members of the deceased person's family. On the other hand, the registrar's figures contain some deaths which ours do not; namely, those occurring in the early months of gestation.

4. Deaths occurring during the puerperal state from certain complications, such as heart disease, acute infections and a miscellaneous group, are included in our figures. They would not be included in similar figures compiled in England and Wales. It seemed fair, however, to include them in this case, since undoubtedly the existence of the pregnancy was a deciding factor in the causation of death. We have clearly indicated, nevertheless, in the appropriate place, the number of such deaths due to complications, so that the reader can

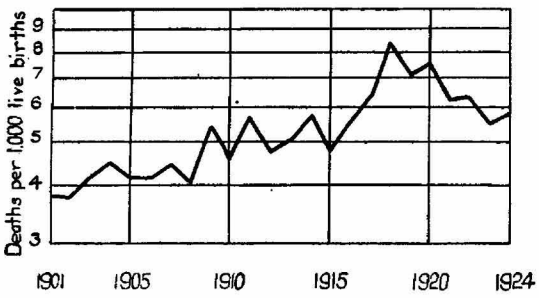

Chart 1.—Maternal mortality in Massachusetts.

see for himself the relation they bear to the whole number of deaths and may make such allowances therefor as he may wish.

5. In approximately 10 per cent. of the cases, our final diagnosis represents a deviation from that given as the primary cause of death on the death certificate. This change in diagnosis is based on the information obtained from the attending physician and the hospital, and a careful study of the whole record.

The method of study was as follows: The work outside the city of Boston was carried on by three physicians on the staff of the Division of Hygiene of the Massachusetts Department of Public Health. The records of deaths occurring in Massachusetts for the years 1922 and 1923 were supplied them by the registrar of vital statistics, together with the facts recorded on the death certificates, as signed by the attending physicians. The deaths occurring in the city of Boston (277) were investigated by the Boston Health Department, which has kindly allowed us to incorporate its results into the general state figures. In this state-wide study only those deaths were included which occurred in women six months or more pregnant, and those which occurred within one month after delivery. It was found necessary to reject certain others as well; namely, cases in which the cause of death bore no particular relationship to pregnancy or childbirth, such as automobile accidents and multiple burns.

The physicians making the study, having the information given by the death certificates in their possession, visited all those who had any special knowledge concerning the cases. This would include, first of all, the attending physician, and then the hospital, if the patient had been delivered or died at the hospital; and in certain instances, visits were made to the homes to get informa-

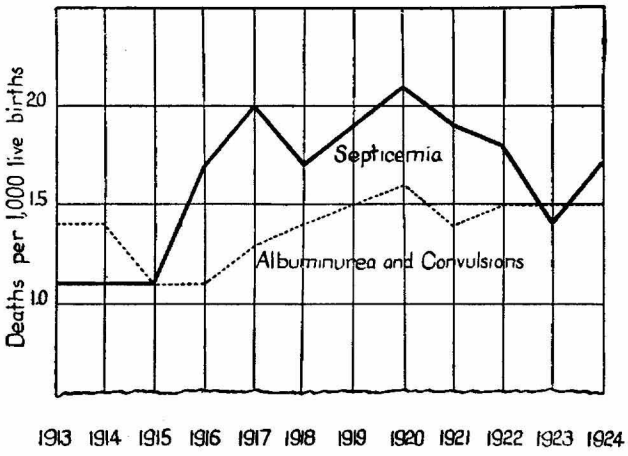

Chart 2.—Causes of maternal mortality in Massachusetts.

tion regarding the social condition of the family in which the death occurred.

Some of the deaths were located not through maternal death certificates but as incident to a study of infant deaths.

This statement of our method of study, and difficulties in relation thereto, brings us to the need of defining clearly what we mean by the terms which we are using in this paper.

(*a*) Deaths in the puerperal state: A death occurring in the case of a woman six months or more pregnant from some cause directly related to or seriously influenced by pregnancy or childbirth. This does not, of course, include all the deaths in the puerperal state

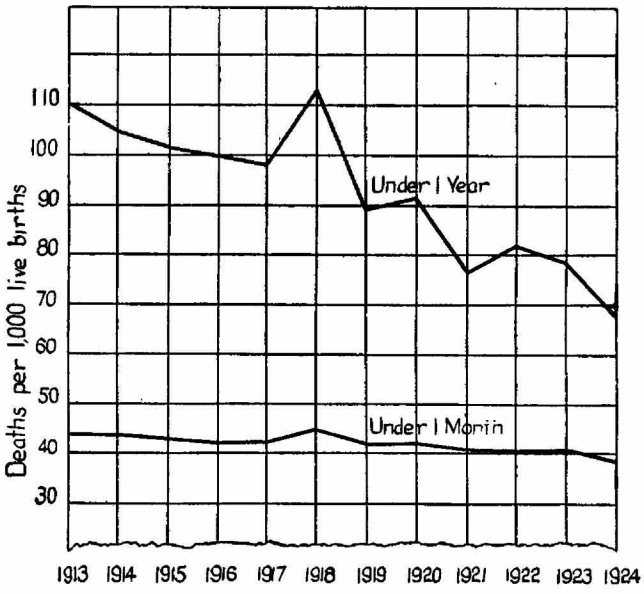

Chart 3.—Infant mortality in Massachusetts.

which might have been found had we included those under six months' gestation.

(*b*) Stillbirth: Babies born dead at or after six months' gestation.

(*c*) Premature birth: All babies born alive before full term.

(*d*) Puerperal infection: The following diagnoses: septicemia, peritonitis, salpingitis, septic endometritis, streptococcus infection, pyemia, phlebitis.

(*e*) Toxemia: The following terms appearing on death certificates: eclampsia, toxic vomiting of pregnancy, acute yellow atrophy of the liver in pregnancy, uremia, convulsive toxemia of pregnancy.

(*f*) Hemorrhage: Placenta praevia, premature separation of placenta, uterine bleeding, bleeding throughout pregnancy, postpartum hemorrhage.

(*g*) Preventable and nonpreventable: It is, of course, impossible to draw a hard and fast distinction

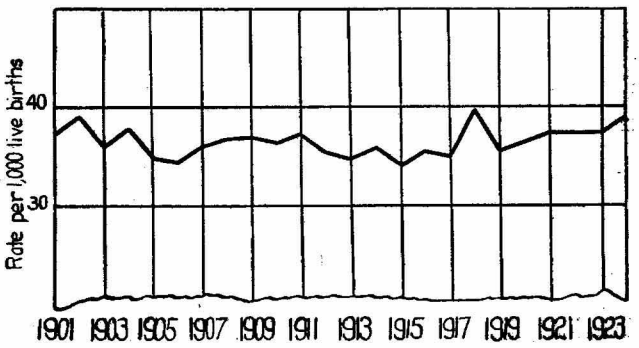

Chart 4.—Stillbirths in Massachusetts.

between these two terms, since many causes which theoretically are preventable often are not practically so, under ordinary circumstances. We, however, are arbitrarily including under the term potentially preventable the following: toxemia; puerperal infection; communicable diseases, such as scarlet fever; neglected hemorrhage at any time during pregnancy or following delivery.

TABLE 1.—*Weekly Income*

Weekly Income	Total
Low	285
Fair or good*	625
Unknown	74
Total	984

* $30 up, fair or good.

TABLE 2.—*Mothers Employed Outside Their Homes*

1922	38
1923	20
Total	58

The mortality is not highest among the poorest but among mothers of moderate means. These are often the ones who get little nursing or hospital care. They feel that they cannot afford it and also are frequently ignorant of what they need.

TABLE 3.—*Occupation of Husband*

Clerical	87
Labor, unskilled	212
Labor, skilled	406
Professional	38
Selling	109
Army and navy	7
Student	10
Unemployed	4
Unknown	120
Total	984

TABLE 4.—*Number and Place of Delivery of Single Mothers*

Year	Home	Hospital	Total
1922	1	10	11
1923	5	17	22
Total	6	27	33

TABLE 5.—*Deaths Arranged According to Birthplace of Patient's Mother*

America (colored, 14)	264	Albania	4
Ireland	198	Norway	4
Canada	152	Newfoundland	3
Italy	74	Armenia	3
Russia	46	Denmark	3
England	32	Belgium	2
Portugal	27	Syria	2
Poland	26	Holland	2
France	25	Austria	2
Scotland	20	West Indies	2
Sweden	16	Cape Verde Islands	1
Germany	10	Switzerland	1
Greece	8	Spain	1
Lithuania	6	Turkey	1
Finland	6	Unknown	43
Total			984

TABLE 6.—*Deaths According to Birthplace of Patient*

United States	584	West Indies	3
Canada	95	South America	3
Ireland	79	Norway	3
Italy	63	Belgium	2
Russia	32	Syria	2
Poland	23	Austria	2
Portugal	17	Denmark	2
England	14	Armenia	2
Scotland	10	Holland	2
Sweden	8	Turkey	1
Greece	8	Switzerland	1
Lithuania	7	Spain	1
Newfoundland	5	France	1
Finland	4	Mexico	1
Germany	4	Unknown	1
Albania	4		
Total			984

TABLE 7.—*Midwives*

Year	Number Mentioned
1922	14
1923	8

Midwives evidently did not play an important part in this series of deaths.

TABLE 8.—*Month of Pregnancy and Cause of Death*

	Months of Pregnancy					
Cause of Death	6 Mo.	7 Mo.	8 Mo.	9 Mo.	Unknown	Total
Puerperal infection	9	11	9	190	4	223
Toxemia	17	43	36	113	8	217
Acute infections	12	26	21	77	4	140
Hemorrhage	9	15	25	75	5	129
Embolism	3	7	7	80	..	97
Heart disease	5	5	7	30	2	49
Shock	..	..	..	35	1	36
Nephritis	4	8	4	8	2	26
Acute dilatation of heart	..	1	4	14	..	19
Intestinal obstruction	1	3	..	10	..	14
Ruptured uterus	2	1	..	6	..	9
All others	8	..	..	17	..	25
Totals	70	120	113	655	26	984

TABLE 9.—*Acute Infections Included*

Pneumonia	112
Tuberculosis	16
Scarlet fever	6
Erysipelas	2
Streptococcus infection (extra-uterine)	1
Septic sore throat	1
Septic hand	1
Diphtheria	1
Total	140

Hemorrhages in sixty-seven cases were antepartum and in sixty-two were postpartum. Thirty-nine patients were known to have had heart disease during pregnancy; eight were not known to have had heart disease during pregnancy; in two cases it could not be ascertained from the history.

TABLE 10.—*Age and Number of Pregnancies*

Number of Pregnancies	Age: Under 20	20-24	25-29	30-34	35-39	40+	Unknown	Total
1	33	120	106	62	39	9	2	370
2	7	29	45	49	25	3	..	159
3	1	12	27	37	26	11	1	115
4	1	7	14	27	27	9	1	86
5	..	..	12	22	16	9	..	59
6	..	..	9	25	14	9	..	57
7	..	..	1	10	14	12	1	38
8	..	..	..	5	9	10	..	24
9	..	..	1	3	9	2	..	15
10	..	..	..	1	8	5	..	14
11	..	..	..	2	7	5	..	14
12	..	..	..	..	5	3	1	9
13	..	..	..	1	2	2	1	6
14	..	..	..	1	1	1	..	3
15	..	..	..	..	1	1	..	2
16	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..
19	..	..	..	..	..	1	..	1
20	..	..	..	..	..	1	..	1
Unknown	..	1	2	4	4	..	..	11
Totals	42	169	217	249	207	98	7	984

These mothers died in the prime of life when their growing families had the greatest need of them.

TABLE 11.—*Fate of Baby*

Undelivered	58
Living	505
Stillborn	289
Died under 1 month	116
Died at 1 month or over	25
Unknown	15
Total	1,003

Nineteen pairs of twins.

Of the 1,003 babies who were born to the 984 mothers, 289 were stillborn and 141 died early, a total loss of 430 infants which, added to our maternal deaths, makes a total loss of life in connection with pregnancy and childbirth, of 1,414 (Tables 10 and 11).

TABLE 12.—*Place and Method of Delivery*

	Spontaneous	Operative	Unknown	Total
Delivered in hospital:				
Emergency	61	234	2	297
Routine	79	224	..	303
Unknown	2	2	1	5
Total	142	460	3	605
Delivered at home, but died in hospital	55	25	4	84
Delivered and died at home	130	107	5	242
Totals	327	592	12	931
No delivery*	...	...	..	53
Totals	327	592	12	984

* Thirty-four of these patients died in a hospital.

One noticeable fact in connection with delivery is the large number of mothers known to have been delivered in hospitals (Table 12), nearly two thirds, all told (615). Over half of these mothers (349) were emergency hospital cases rushed in, for the most part, after serious complications had arisen, so that the apparently high mortality of those having hospital delivery is easily comprehended.

TABLE 13.—*Reason for Sending Patient to Hospital After Delivery at Home*

Puerperal infection	48
Convulsions	6
Pneumonia	5
Hemorrhage	5
Ruptured uterus	3
Uremic coma	2
Psychosis	2
Pelvic abscess	2
Twisted pedicle, cyst of ovary	1
Anemia	1
Inversion of uterus	1
Influenza	1
Scarlet fever	1
Heart disease	1
Toxemia	1
Traumatic ileus	1
Tuberculous peritonitis	1
Gangrene of leg	1
Precipitate delivery on way to hospital	1
Total	84

TABLE 14.—*Cause of Death and Method of Delivery of the Two Hundred and Forty-Two Patients Who Were Delivered and Died at Home*

	Spontaneous	Operative	Unknown	Total
Puerperal infection	19	18	2	39
Toxemia	11	19	1	31
Acute infections	44	12	..	56
Hemorrhage	15	20	..	35
Embolism	24	9	..	33
Heart disease	7	7	1	15
Shock	..	13	..	13
Nephritis	4	..	1	5
Acute dilatation of heart	1	3	..	4
Ruptured uterus	..	3	..	3
All others	5	3	..	8
Totals	130	107	5	242

TABLE 15.—*Cause of Death and Method of Delivery*

Cause of Death	Spontaneous	Forceps, Low	Forceps, Middle	Forceps, High	Version	Version and Forceps	Cesarean Section	Other Operative Procedure	No Delivery	Unknown	Total
Puerperal infection	87	15	9	25	15	5	53	9	..	5	223
Toxemia	48	11	11	22	34	3	54	6	24	4	217
Acute infections	85	12	2	8	6	1	13	6	7	..	140
Hemorrhage	25	5	5	9	40	10	18	10	6	1	129
Embolism	43	10	6	8	5	1	16	3	5	..	97
Heart disease	17	5	..	4	4	1	7	5	5	1	49
Shock	1	2	..	10	6	9	5	2	1	..	36
Nephritis	8	..	..	2	2	..	7	3	3	1	26
Acute dilatation heart	3	3	1	1	..	..	10	1	..	..	19
Intestinal obstruction	..	..	..	..	..	1	13	..	..	..	14
Ruptured uterus	..	1	..	3	1	1	2	1	..	..	9
All others	10	1	..	..	2	1	6	3	2	..	25
Totals	327	65	34	92	115	33	204	49	53	12	984

Of the 984 cases, 592 were associated with operative intervention.

TABLE 16.—*Cesarean Sections*

	Number	Per Cent.
Operation done as an emergency measure	133	65
Operation not an emergency	71	35
Totals	204	100

TABLE 17.—*Length of Time Mothers Lived After Delivery*

Died	Number
On day of delivery	280
During first week	642
During first two weeks	788
Before thirty-two days	984

Maternal mortality is highest during the first week after delivery, about two thirds of the deaths occurring during this time. (This may be compared with infant mortality, which is highest during the first week of life.) In the large group of "early" maternal deaths, nearly one half of the patients died the day of delivery.

TABLE 18.—*Necropsies and Cause of Death*

Puerperal infection	11
Toxemia	5
Hemorrhage	3
Heart disease	3
Intestinal obstruction	3
Embolism	3
Pneumonia	2
Scarlet fever	1
Syphilis	1
Nephritis	1
Ruptured lung	1
Surgical shock	1
Total	35

TABLE 19.—*Number of Living Children These Mothers Left*

Number of mothers	984
Number of children left by these mothers	2,156

Many homes were broken up by the mother's death. Obviously, the large group of motherless children stand handicapped in environment under these conditions, and add greatly to the serious and far-reaching consequences of maternal mortality.

TABLE 20.—*Prenatal Care: Number of Months and Type of Care*

	Type of Care				
Number of Months	Urinalysis	Blood Pressure	Vaginal or Rectal Examination	Pelvic Measurements	No Examinations
"Some prenatal care"	11	5	6	4	4
Less than 1 month	43	25	11	15	6
1 month	46	28	13	23	6
2 months	58	38	13	32	3
3 months	92	72	30	46	2
4 months	52	46	19	32	3
5 months	43	42	18	31	2
6 months	81	69	34	50	1
7 months	48	50	16	32	3
8 months	96	87	32	65	2
Totals	570	462	192	330	32

The standard used was the so-called "Grade A" care; that is, (1) monthly visits to clinic from fifth through ninth month of pregnancy, or supervision by private physician from fifth through ninth month; (2) monthly urinalysis from fifth through ninth month; (3) at least an abdominal examination; (4) pelvic measurements, if a primipara. In this series only 107, or 11 per cent., of the patients had received the standard care.

TABLE 21.—*Cause of Death of Primiparas and Multiparas*

Cause of Death	Primiparas	Multiparas	Unknown	Total
Puerperal infection	101	119	3	223
Toxemia	99	117	1	217
Acute infections	42	96	2	140
Hemorrhage	23	105	1	129
Embolism	41	56	..	97
Heart disease	15	32	2	49
Shock	14	21	1	36
Nephritis	8	18	..	26
Acute dilatation of heart	8	10	1	19
Intestinal obstruction	6	8	..	14
Ruptured uterus	..	9	..	9
All others	13	12	..	25
Totals	370	603	11	984

TABLE 22.—*Prenatal Care and Cause of Death*

	Prenatal Care											
Cause of Death	None	Some Less than 1 Month	1 Month	2 Months	3 Months	4 Months	5 Months	6 Months	7 Months	8 Months	Unknown	Total
Puerperal infection	76	4 7	12	9	26	16	8	19	15	26	5	223
Toxemia	79	2 23	18	15	22	9	11	15	5	17	1	217
Acute infections	61	2 8	7	7	9	8	8	13	6	9	2	140
Hemorrhage	53	5 6	4	8	12	5	4	9	8	13	2	129
Embolism	24	1 1	2	11	8	7	6	14	10	12	1	97
Heart disease	14	1 2	2	5	8	2	1	2	4	6	2	49
Shock	12	.. 1	1	2	6	3	..	3	..	7	1	36
Nephritis	9	2 3	2	1	1	1	..	1	4	1	1	26
Acute dilatation of heart	3	.. ..	2	2	..	1	2	2	1	5	1	19
Intestinal obstruction	4	.. ..	2	1	2	..	1	2	..	2	..	14
Ruptured uterus	3	.. ..	2	..	1	2	..	..	1	..	..	9
All others	10	.. ..	3	1	3	1	4	2	1	..	..	25
Totals	348	17 51	57	62	98	55	45	82	55	98	16	984

CONCLUSIONS TO BE DRAWN FROM THIS STUDY

From this study of almost 1,000 maternal deaths, certain conclusions may be drawn as to the quality of obstetric service, including prenatal care.

It must be quite evident that with such a large percentage of the deaths due to infection and toxemia, more intense medical service is needed. The part that prenatal care plays in the prevention of toxemia is sufficient evidence of this. Over 52 per cent of our cases had less than three months of so-called prenatal care. Moreover, we know that much that passes for prenatal care is unworthy of the name. Thirty-five per cent. had no prenatal care at all. If we accept the standards given by Woodbury of the Children's Bureau as constituting Grade A (Table 20) prenatal care, which involved adequate oversight from the fifth through the ninth month of pregnancy, then 89 per cent. of our cases did not have adequate prenatal care. Furthermore, it is obvious that even Grade A care is far from ideal, since supervision should begin at the earliest possible period of pregnancy.

When we turn to the handling of the confinement itself we find puerperal septicemia, a preventable disease, still sharing with toxemia, another preventable disease, the first place on the list of causes of death. With all the modern facilities, we should naturally expect to see a greater drop in deaths from all preventable causes. It is a matter for serious concern that such a drop is not to be seen even after making all reasonable allowance for better reporting and greater accuracy in diagnosis, as well as for changes in methods of reporting deaths. There is encouragement, however, in the fact that the death rate for septicemia, formerly on the upward trend, during the last three years has shown a downward tendency, as has the death rate from all diseases caused by pregnancy and confinement since the 1918 high peak caused by the influenza epidemic.

It may well be asked, What can public and private initiative do to remedy the shortcomings this study has emphasized? These data tell us only about the handling of the unsuccessful pregnancies; they do not give us the facts as to the successful pregnancies, so that we do not know exactly how to gage the relative importance of the methods employed in the successful cases.

There are, however, experiments which point the way to the answer. Various organizations in this country have had enough experience with prenatal care to be able to draw reasonable conclusions. The most striking effect has been on the neonatal mortality, which has been reduced as much as 50 per cent., apparently as the result of prenatal care. Reduction in the number of still-births has occurred in some instances, though this is a less constant result. The maternal mortality has also been noticeably less when adequate prenatal care has been given. Those interested in studying these facts will find material in the reports of the Maternity Center in New York; of the Association for Improving the Condition of the Poor, New York; of the Community Health Association of Boston, and of public and private clinics in many of the large cities of this country.

If this adequate prenatal care is to be given with its attendant saving of life, there must be cooperation to this end between physician and patient, since neither is wholly responsible for either success or failure. A further campaign of education as to the value of prenatal care seems to be indicated.

SUMMARY

Certain outstanding facts are evident from this study of 984 maternal deaths in Massachusetts:

1. Septicemia, toxemia and hemorrhage, causes of death which may be called generally preventable, were responsible for 58 per cent. of the deaths.

2. The part played by operative intervention with labor cannot be shown statistically from this series of cases, since records are not available as to the total number of operations performed with and without success. A clear impression was gained, however, by our physicians, during the course of this study, that many thoughtful general practitioners have come to the conclusion that this factor of operative intervention is of considerable importance in the total of unfavorable results, even after making allowance for the cases inevitably operative from the beginning. In 591 of our series of 984 cases, operative procedures figured.

3. Lack of adequate prenatal care was evident in 89 per cent. of the cases.

4. Poverty as a cause of maternal mortality did not stand out in this series of cases.

5. Twenty-five per cent. of the mothers who died were Americans; that is, their mothers were born in the United States. This factor counts for little, however, since we do not know the racial distribution of all pregnancies in the years in question.