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RESULTS OF INVESTIGATIONS OF CAUSES OF DEATH AT CHILDBIRTH.*

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A Further Preliminary Note on Studies Being Made in the Vital Statistics Division, New York State Department of Health

IN this paper we shall present some general provisional statistics from studies of puerperal mortality which have been in progress in our office during the past year. I am pleased to acknowledge the help I have received from my Research Assistant, Miss Carolyn A. Bonds, in preparing this paper. I am indebted to her for most of the arduous labor involved in compiling and analyzing the primary data upon which my comment is based. In the brief time at our disposal it will be impossible to do more than merely indicate some of the more interesting features of these data from a descriptive standpoint.

The death rate from causes connected with childbirth has been relatively high in New York State for many years. During the seven years, 1915-1921, the death rate from all puerperal causes combined in the city of Birmingham, England, was below 35 per 10,000 births and stillbirths combined; in New York City during those years it ranged between 44 and 70; and in New York State, outside of New York City, it varied from 53 to 83. There occurred in the entire State of New York during the five years, 1918-1922, exactly 7,000 deaths from all puerperal causes, of which 3,461 were registered in New York City and 3,539 in the rest of the State. Puerperal sepsis comprised 27 per cent of these deaths in the entire State, 25 per cent in New York City, and 30 per cent in the rest of the State.

Although the trend of the death rate from all puerperal causes combined was generally downward from 1910 to 1916 in New York State, it rose sharply in 1917 and reached a high peak in 1918. Since then it has declined, but the mortality has remained at a higher level than during the years 1912-1916. The rate fell from 65.1 in 1910 for the entire State, to 49.1 in 1916, rising sharply to 75.3 in 1918, and dropping to 51.7 in 1923. The death rate from puerperal sepsis declined from 22.3 per 10,000 births and stillbirths combined for the entire State in 1910, to 12.5 in 1923. (Chart I shows the trend of the death rate for New York City and for the State, exclusive of New York City.)

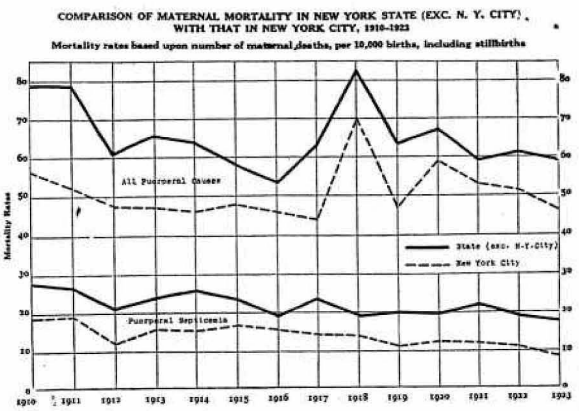

CHART I

There is a very regular seasonal variation in maternal mortality in New York State. The average monthly death rate from all puerperal causes combined is highest in March and then declines gradually to a low point in September, after which it again rises gradually to the highest rate in March. The average March rate during a recent seven-year period, 1914-1920, was 65.5, and the lowest average monthly rate, in September, was 41.2, or about two-thirds the March rate. There is a similar marked seasonal

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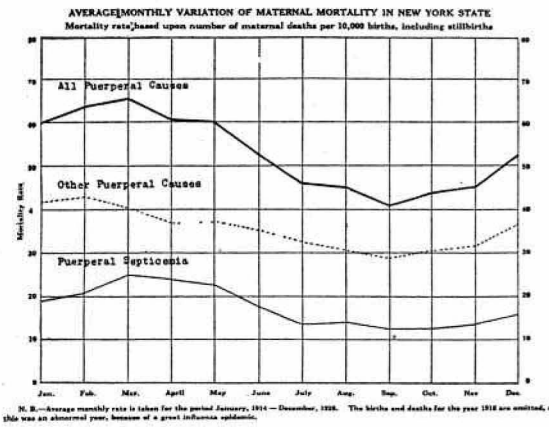
variation in the death rate from puerperal septicemia and from all puerperal causes, exclusive of septicemia (see Chart II). This seasonal varia-



N. B.—Average monthly rate is taken for the period January, 1914—December, 1918. The births and deaths for the year 1918 are omitted, as this was an abnormal year, because of a great influenza epidemic.

CHART II

tion may possibly be attributed to the greater prevalence of respiratory and renal diseases in the colder months; our final analysis may show definitely whether or not this will account for it.

The average annual number of live births in the entire State of New York is 238,364 and of stillbirths, 10,110; the average annual number of deaths for mothers from all causes connected with childbirth is 1,364. During the five years, 1916-1920, stillbirths in this State comprised 4.07 per cent of the total births. During the same period the maternal death rate was 54.90 per 10,000 births, including stillbirths; the septicemia rate, 16.44; and that from all other puerperal causes, 38.46. The deaths from puerperal septicemia comprised just 30 per cent of the total deaths from puerperal causes.

During the five years, 1916-1920, the death rate from *all puerperal causes* was 46.72 per 10,000 births and stillbirths combined in New York City, and 65.87 in the rest of the State—nearly 20 points higher in the latter area. Dividing the rest of the State into urban and rural, the rate for places *under* 2,500 population was 58.51; that for cities *over* 2,500, 69.42; and that for villages *over* 2,500, 71.07. In other words, the death rate is lowest in the very *rural* area of the State.

The death rate from puerperal *septicemia* for the entire State for the five years, 1916-1920, was 16.44; for New York City, only 13.58; and for the rest of the State, 20.29. In the rest of the State the rural septicemia rate was 15.58, and for all cities over 2,500 population it was 23.04.

For the entire period of thirteen years, 1910-1922 inclusive, the mortality from all puerperal causes combined was higher for Upstate* than for New York City, the same being true for the death rate from septicemia.

Our publication on the geographical distribution of maternal mortality and stillbirths in New York State shows very great differences in the rates of mortality from causes connected with childbirth in the various counties, cities, and villages of the State. This local variation in rates cannot be accounted for by chance alone, nor are there any outstanding conditions which afford a ready explanation. The presence of many non-resident patients in hospitals is not a factor of great importance in most instances and the practise of arbitrarily excluding non-resident deaths from the rates is not warranted. If this were done, then births to non-resident mothers should likewise be excluded to make the adjustment honest. Moreover, various large cities which contain institutions receiving many non-resident patients, have very low rates, e.g., the average death rate from all puerperal causes in Buffalo, Rochester, Syracuse, Utica, Albany, Binghamton, Schenectady, etc., is below 74 while the rate runs as high as 166 in Watertown, Ogdensburg, Plattsburgh, Middletown, Batavia, etc. Likewise, the average mortality from puerperal septicemia is 20 or below in such large cities as Buffalo, Schenectady, Rochester, and over 40 in Little Falls, Middletown, Plattsburgh, Watertown, Ogdensburg, etc.

Of the many factors to be considered in studying these conditions, not the least important is perhaps the fact that the larger cities have more hospitals, skilled nurses and midwives, and more obstetrical specialists, including physicians who limit their practise entirely to their field. Also, in the large cities a high percentage of births occurs in institutions and the average maternity case probably receives better prenatal and postnatal care. A condition which is perhaps inconsistent with this speculation is the low rural rates, especially from septicemia. I think in this instance the non-resident factor is doubtless important, as many critically ill patients are removed from rural districts to city hospitals.

In this connection it is unfortunate that puerperal septicemia is not better reported as a disease. During the three years, 1920-1922, there were registered in the entire State of New York 1,148 deaths from sepsis and only 877 cases. As during this period there were reported in New York City more cases than deaths, it is obvious that failure to report sepsis must be very extensive among Upstate physicians, or else the infection is more promptly or effectively treated in New York City.

As the suspicion might reasonably exist that the septicemia deaths occur chiefly in the practise of a relatively few physicians and midwives, an attempt was made to determine the facts. Hence we analyzed the distribution of sepsis deaths in the cities to ascertain their prevalence

* The terms "Upstate" and "Rest of State" are synonymous.

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in the practise of individual physicians. The result showed that they were not at all limited significantly to the practice of any one or any group of physicians in any city; indeed, they were more or less uniformly distributed among many physicians, including men of high reputation as to character and skill. In the city of Troy, during a recent five-year period, there occurred 26 septicemia deaths in the practice of 21 physicians, only one man having as many as three.

Perhaps the commonest explanation offered of our high maternal death rate is that midwives are chiefly to blame. The truth of this also was susceptible of rather close determination, by making direct inquiries of the physicians who registered puerperal deaths during the twelve months preceding July 1, 1923. There were recorded Upstate 687 deaths from causes connected with childbirth; replies to our inquiries, satisfactory for analysis, were received from physicians for 485, or 71 per cent of these deaths. In these replies we are confronted by the bald fact that only 18, or 3.7 per cent, of the patients had been under the care of a midwife at some period before a physician was called. This in itself shows at once that the midwife is by no means the important factor she is accused of being. It must also be remembered that the term "midwife" can be loosely used. The same careful distinction should be drawn between the irregular unlicensed "midwife" and the bona fide trained woman, licensed by the State to practice midwifery on the basis of her qualifications, as between the regular physician with an "M.D." degree and the chiropractor and other irregular practitioner. The professional midwife should not be blamed for the misdeeds of alleged midwives.

Careful reading of the physicians' reports on these 18 patients previously attended by midwives shows that *7 of them died of septicemia and* 11 *from other puerperal causes.* These reports fail to show how many of the so-called midwives were licensed or qualified to practice midwifery. Of these 11 deaths there were only two in which it seemed definitely clear that the midwife may have been to blame, viz., deaths from hemorrhage due to placenta previa. Of the remaining 9 cases, one died of tuberculosis—the physician believed overwork and her large family were contributory causes and fails to blame the midwife. Another died of nephritis and profound anemia; although she had been attended by a midwife, the doctor's description of her general health shows it was so poor for two years preceding that pregnancy itself was inadvisable and dangerous; he exonerates the midwife by saying "her death was indirectly self-induced." Three other died of eclampsia; one complicated with broncho-pneumonia and one with acute nephritis. All three are blamed on lack of prenatal care, for which, obviously, the midwife is not responsible. In another case, the patient died suddenly from pulmonary embolism following difficult labor, and the physician believes there was only a "very faint possibility of saving her had she been delivered earlier," and, therefore, does not seem to blame the midwife. Another died from postpartum hemorrhage, which the physician states was not recognized early enough, atlhough he also states that he was called by the midwife. One patient, very anæmic, died from rupture of the uterus, the physician believing she might have been saved if a Caesarian section had been performed; it appears that he was called by the midwife when the patient's serious condition was discovered, hence she probably was not to blame and certainly not for the abnormal condition which existed. Another patient died following Caesarian section done for malposition and some very obscure obstacle to delivery, which three physicians were unable to positively diagnose. Detailed history of the case shows the midwife called a physician after the patient had been in labor about 12 hours—she had given birth to 12 children with no great difficulty. The physicians, themselves, attempted version, forceps, etc., without success, eventually delivering a child which died soon afterward. The report states it is possible that the patient might have been saved if a physician had been called earlier, but their clear history of the case shows her condition was extremely grave from the beginning. Finally, there are two cases in which it is highly probable that the midwives, both licensed, may have been at fault; both patients died from hemorrhage due to placenta previa and in both instances it seems probable that the seriousness of the condition was not recognized early enough or the physicians not called soon enough. Therefore, out of the entire 11 deaths from causes other than sepsis in which midwives, licensed or otherwise, preceded the physician, there are only two, or less than one-half of one per cent of the total classified deaths, in which the midwives' responsibility can be assumed with reasonable certainty.

During the 12 months preceding last July 1, 1923, 205 deaths from puerperal sepsis were registered in Upstate New York (this cause being given alone or associated with other causes). Inquiries sent to the reporting physicians resulted in 138 replies satisfactory for tabulation, or 67 per cent of the total 205 deaths. As we have just noted, only seven cases had a midwife in attendance before a physician was called. In only two of these does the physician directly blame the alleged midwife and in one, some other physician was in attendance after the midwife delivered the woman; in the other the criminal abortion was performed by an alleged midwife in New Jersey. Of the other five sepsis cases, in one the physician states the infection

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resulted from a previous pelvic disease and that the patient had adequate care preceding and during confinement; in another, the physician exonerates the midwife and states he "knows of no circumstances under which the patient might have been saved." In the remaining three cases, the midwife is not blamed and either the patients were seriously ill before she was called, other physicians followed the midwife, or for other reasons she can be absolved from suspicion.

Hence, to sum up, out of the total 18 cases in which the midwives were involved, critical examination of the physicians' own reports reveal that in only 4 cases, or less than 1 per cent, were they able to definitely implicate the midwife. In addition, in most of the 18 cases the question must be raised as to whether or not the so-called midwife who preceded the physicians was a bona fide licensed midwife or an irregular practitioner. Without elaborating further on the question I think these facts obtained from the Upstate medical profession may be accepted as showing definitely that the midwife is an almost negligible factor in the causation of puerperal mortality. This conclusion is consistent with many facts and conditions which there is insufficient time at our disposal to discuss.

An interesting and striking fact disclosed by our preliminary data is that where the fetus has developed to the fifth month or over of utero-gestation, the fetal mortality is 53 per cent among those born to mothers who died from causes connected with childbirth. Out of 1,885 deaths of mothers from maternal causes for which a corresponding birth was reported, 617 of the infants were stillborn and 1,268 live born. Of the live born, 374 died before they completed the first year of life, thus the mortality of the children born to these 1,885 mothers was 991, or 53 per cent. But, during this period there were, in addition to these 1,885 deaths, 1,048 other deaths of mothers in childbirth for whom no birth certificates were found. As the reasons for not finding them in many or most cases were that no child was born or that the fetus was under five months utero-gestation, it is plain that the fetal mortality is very much higher than 53 per cent.

The notes we have already published show that in Upstate New York the death rate of women from all puerperal causes, from puerperal septicemia, and from all other puerperal causes, in each five-year age group at from 15 to 50 years, in proportion to every 10,000 confinements of mothers of corresponding age groups, shows a striking regularity of increase at each successive age from 20 to 50 years, with a rate at the age 15 to 19 slightly above that at 20 to 24. The rate of stillbirths by ages of the mothers shows the same regular distribution upward (see Chart III). When the mortality among married

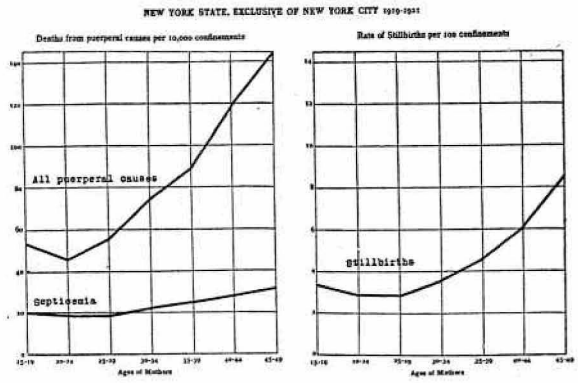

CHART III.

mothers is shown separately, the general distribution is similar, viz., the death rate increasing with the ages of the mothers.

The death rate from all puerperal causes combined in proportion to 10,000 births and stillbirths increases steadily according to the number of children the mother has had. The mortality shows a high point for primiparae—being 60.6 per 10,000; for mothers who have had from two to seven children the mortality varies between 38 and 45; for each child the mother has beyond seven the mortality increases, reaching the very high point of 155.6 per 10,000 for mothers who have had 14 children. The curve showing the distribution of these death rates resembles that of mortality of mothers by their ages described above. These data seem to be highly significant as showing that the risk of death to the mother increases with each child born beyond the number of seven. In fact, the rate shows a slight increase for each child born beyond the number of two, but rises rapidly after the seventh child is born.

Our data on the frequency of maternal mortality, according to the nativity of mothers, shows the mortality is higher among the native born white mothers than among the foreign born white. Of the foreign born, it is higher among Germans, Canadians, and Scandinavians, and lowest among the Russians (including Russian Hebrews), and next lowest among Austrians, Hungarians and Poles. The mortality among the colored is very high—nearly twice as high as the native white.

Our preliminary data indicate the frequency of abortion, miscarriage, and premature birth, including criminal and self-induced abortion, as the cause of puerperal sepsis. Out of 477 sepsis deaths which we are studying, 299, or 62.7 per cent, were from these causes. Criminal and self-induced abortion preceded septic infection in 82, or 17.2 per cent of the total 477 deaths; in other words, a little less than one-fifth of the septicemia deaths followed criminal interference, and over one-half followed abortion, miscarriage, or

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premature birth, whether criminal or otherwise.

As to diseases associated with important puerperal causes of death, it may be of interest to mention that out of 2,933 puerperal deaths we are studying, there were 1,347, or about one-half, in which the death was attributed by the physician to a single cause; and 1,337, or almost an equal number, in which the cause of death was associated with one contributory condition, either puerperal or other illness. There were only 243 deaths in which the primary cause of death was associated with two contributory causes. For example, out of 2,933 deaths the primary cause in 670, or 23 per cent, was due to toxemia of pregnancy; this toxemia of pregnancy occurred without any contributory cause in 420 cases, or 63 per cent of all the toxemias; 215, or 32 per cent of the toxemias had one contributory cause; and 33 cases had two contributory causes. Of the total 2,933 puerperal deaths, 370, or 13 per cent, were caused by abortion, miscarriage, and premature labor, including criminal and self-induced abortions. Ectopic gestation was the primary cause of death in 100 cases, or 3 per cent of the total. Acute and chronic infectious disease, such as typhoid, influenza, pneumonia, tuberculosis, etc., were the primary causes of death in 369, or 13 per cent of the cases. Puerperal hemorrhage, including placenta previa, was the primary cause of death in 240, or 8 per cent of the cases. Puerperal infection was the primary cause in 346, or 12 per cent of the cases. Our final results will, of course, show all the causes in detail and also associated with other contributory causes.

In order to discover, if possible, some of the basic conditions under which the deaths from puerperal causes occur in this State, certain questions were submitted, during a period of twelve months preceding last July 1, 1923, to each physician who reported a death from any cause connected with childbirth. Inquiries were made concerning 687 puerperal deaths and replies suitable for tabulation were received for 485 cases, or 71 per cent. Of the 485 deaths, 58 per cent occurred in hospitals. Puerperal sepsis as a cause of death in these cases has already been described in detail above, likewise the factor of the midwife. Other facts of importance found were that 30 per cent of the sepsis deaths were reported by physicians as having been *previously under the care of some other physician,* and only 2 per cent under the care of the same physician until death occurred. Of the 485 deaths, 72 per cent were reported as having had a trained nurse or other competent attendant during the puerperium, and 28 per cent were attended by friends, members of the family, neighbors, etc. Hospital care was advised by the physicians in 69 per cent of the cases and was not advised in 22 per cent; 4 per cent of the patients were unable to go to hospitals as they were too ill to go, or hospitals were too far distant. Of those who were not advised to go, many were believed by physicians to be dying or too ill to be moved any distance. Of those who were advised to enter hospitals, 75 per cent consented and 17 per cent refused; 7 per cent of the patients consented to go to the hospital only after their condition became extremely serious. The reporting physicians stated they believed that the patients had received adequate medical care before confinement in 54 per cent of the cases; that they had not received adequate care in 37 per cent; and that the type of care was unknown for 9 per cent. Of those who had not received adequate medical care before confinement, the physician stated in many instances that it was due to ignorance, neglect, or poverty. Only 2 per cent of the patients refused consultation when it was advised by the attendant. In 9 per cent of the cases, the physician did not advise consultation—possibly because competent advice was not available or the patient was already dying when the physician was called. Obstetricians were available for consultation in the communities of 77 per cent of the decedents, were not available in only 12 per cent, and for only 3 per cent of the cases did the physicians report that obstetricians were many miles distant. This would indicate that for not less than one case out of ten there was no obstetrician available for consultation.

Obstetrical operations, such as version, Caesarian section, high and low forceps, traction, craniotomy, laparotomy, etc., were performed in just 50 per cent of the cases. *The physicians reported that in* 42 *per cent of the entire* 485 *puerperal deaths the patient had been previously suffering from an illness which endangered her life when she became pregnant.* Many of these illnesses were such chronic conditions as tuberculosis, heart disease, etc. In only 35 per cent of the cases did the physicians report that there were circumstances or conditions under which the patient's life might have been saved, and in 25 per cent that there were no conditions under which the patient could have been saved. In the remaining cases, on this point the physicians were doubtful or uncertain.

Conclusions

It is a fact, shown by our inquiries and well known to all physicians, that some patients, in spite of the most thorough and competent medical care from the time of conception, and under the most favorable circumstances, will develop abnormal puerperal conditions resulting in death, and that even fatal septic infection will occur from no cause which the physician can determine. The prevention of death in the remainder of the cases would seem to depend upon the following:

1. Education of the public as to the necessity for competent medical prenatal care, and as to

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the very grave dangers of criminal or self-induced abortion.

2. Education of the public as to the undesirability of confinement of the mother by any one except a person licensed to practice obstetrics or midwifery.

3. Suppression of the criminal abortionist.

4. Immediate and competent care of the patient suffering from spontaneous or accidental abortion.

5. Education of the public as to the need for prompt medical care of any abdominal condition connected with pregnancy, or any other illness occurring during pregnancy.

6. Adequate clinical and hospital facilities for the care of the poor and those of moderate means.

7. Measures to make available, if possible, expert obstetrical advice for physicians in remote rural districts, or facilities for early removal of abnormal cases to the obstetrical expert.

8. Elevation of the standards of obstetrical training and practice for physicians.

N. B.—This conclusion is warranted by the reports of the physicians themselves on puerperal deaths, which show that in many cases delay or lack of skill on the part of the first physician called seriously endangered the patient's life or actually began the chain of events ending in her death.

9. Extreme aseptic precautions in the care of the patient, especially during and after delivery, and particularly if the patient is suffering from a serious illness not connected with the puerperal condition.

10. Clinical, pathological, and statistical research to discover facts at present unknown, and to determine the routes of puerperal infection.

Finally, in conclusion, it may be added that it would be wrong to convey the impression to the public that pregnancy in itself is a dangerous condition. On the contrary, during a recent five-year period in New York State there were 1,242,374 live births and stillbirths combined, and 6,821 deaths from causes connected with childbirth, therefore, only one-half of one per cent of the mothers died.

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