

INFLUENZA OCCURRING IN PREG-
NANT WOMENA STATISTICAL STUDY OF THIRTEEN HUNDRED
AND FIFTY CASES *JOHN W. HARRIS, M.D.
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In the latter part of October, 1918, when the epidemic of influenza was at its peak in this locality, the seriousness of the disease as seen in pregnant women caused considerable alarm among those in charge of obstetric cases. It soon became apparent that there was a great diversity of experience as regards the mortality, some of the practitioners losing most of their cases, others very few. In addition to its importance in contributing toward a more definite knowledge concerning the prognosis of influenza in pregnant women, it has seemed to me that a statistical study based on a large number of cases would also be of value in showing the effect of the influenza on the course of pregnancy. Owing to its severity and wide occurrence, and to the fact that it was especially prevalent among young women of the child-bearing age, the epidemic offered the best opportunity we have perhaps ever had to study the extent to which the progress of pregnancy is interfered with by an acute, severe, infectious disease.

With these purposes in view, a questionnaire was prepared which included data as to race and age of the individual patient, the month of pregnancy, character of the attack (whether mild or severe, and whether complicated by pneumonia), recovery or death of the mother, and whether or not pregnancy was interrupted. Copies of this blank were sent to all of the physicians of the state of Maryland, and also to the members of the American Gynecological Society, the American Association of Gynecologists and Obstetricians, and the local obstetric societies in four of the larger cities. I wish here to express my appreciation of the ready response on the part of the physicians who replied, and of the careful manner in which they supplied the information desired.

Of the total number of cases returned, 1,350 were reported in full detail, and it is on these that our statistics have been based. Other cases were reported but were not used, owing to incompleteness of the data in some particular respect. Of the 1,350 cases, 971 were from the state of Maryland, and hence the great majority occurred under the same general conditions. In race the patients were predominantly white, the proportion being 1,266 white, eighty-two negro, and two Japanese. Since in most instances the duration of pregnancy was expressed in calendar months, the same method has been followed in this paper.

The results of this study are given herewith in the form of a series of tables in which the statistics are presented so as to show their relation to the various aspects of our problem. By a comparative study of these tables important data are revealed, both as regards the course of influenza in pregnant women and the effect of the influenza on the course of pregnancy. No conclusions can be drawn, however, as to whether the incidence of influenza is greater among

pregnant women than among nonpregnant women or men of the same age. This question cannot be determined until we have reliable statistical data concerning influenza in general. Our own figures show only what happened in this group of 1,350 patients.

TABLE 1.—INCIDENCE OF PNEUMONIA AND PERCENTAGE OF MORTALITY IN CASES OF INFLUENZA REPORTED FOR THE DIFFERENT MONTHS OF PREGNANCY

Month of Pregnancy	Uncomplicated by Pneumonia			Complicated by Pneumonia			Total Cases	Gross Mortality
	No. of Cases	Recover- ed	Percent- age of Mor- tality	No. of Cases	Recover- ed	Died		
1	12	12	0	2	1	1	14	7
2	53	53	0	31	17	14	84	17
3	58	58	0	66	32	36	126	28
4	79	79	0	79	41	38	158	24
5	58	58	0	94	51	43	152	28
6	94	94	0	88	43	45	182	25
7	121	121	0	114	47	67	235	29
8	151	151	0	109	45	64	260	25
9	46	46	0	93	36	57	139	41
Total	672	672	0	678	313	365	1,350	27

As regards the course and prognosis of influenza in pregnant women, we may draw certain general conclusions from Table 1. Our first observation is that about one half of all the patients developed pneumonia, and of these about 50 per cent. died, giving a gross mortality of 27 per cent. In those developing

TABLE 2.—FREQUENCY OF INTERRUPTION OF PREGNANCY IN CASES IN WHICH INFLUENZA WAS UNCOMPLICATED BY PNEUMONIA

Month of Pregnancy	Total Cases	Pregnancy Uninterrupted	Pregnancy Interrupted	Percentage Interruption
1	12	8	4	33
2	53	27	26	49
3	58	40	18	31
4	79	55	24	30
5	58	46	12	21
6	94	81	13	14
7	121	95	26	21
8	151	108	43	28
Total	626	460	166	26

pneumonia, the mortality was somewhat higher in the last three months of pregnancy. From Table 1 it will be seen that the largest number of cases were reported for the sixth, seventh and eighth months, and fewer from the third to the fifth months. As to the first two months, we must assume that in many instances

TABLE 3.—FREQUENCY OF INTERRUPTION OF PREGNANCY IN CASES IN WHICH INFLUENZA WAS COMPLICATED BY PNEUMONIA

Month of Pregnancy	Total Cases	Pregnancy Uninterrupted	Pregnancy Interrupted	Percentage Interruption
1	2	0	2	100
2	31	7	24	77
3	68	29	39	57
4	79	43	36	46
5	94	59	35	37
6	88	47	41	46
7	114	57	57	50
8	109	41	68	62
Total	585	283	302	52

the existence of pregnancy was not suspected by the attending physician, and thus such cases would not be included in the reports. On the other hand, we may well reason that cases from the later months were likely to be reported, pregnancy being then more obvious. This would explain the larger number of

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cases reported for that time. We may safely conclude that the individual is no more susceptible to the disease at any one month of pregnancy than at another.

As regards mortality, the percentage is distinctly higher in the last three months of pregnancy. Sixty per cent. of the cases developing pneumonia in those months proved fatal; in the ninth month it reached its highest point, 61 per cent. When considered as gross mortality the percentage is reduced somewhat, owing to the large number of cases reported for this period.

The effect of influenza on the course of pregnancy is shown in Tables 2, 3 and 4, in which the frequency of coincident abortion or premature birth is tabulated according to the severity of the influenza. In the 626 cases uncomplicated by pneumonia the pregnancy was interrupted in 26 per cent., the ratio being somewhat higher in the first three months. This figure is not greatly in excess of the frequency one would expect under ordinary conditions. Moreover, it is to be remembered that many of these abortions might have occurred in the absence of the disease, or at least that the disease may have served only as a terminal factor in bringing about the abortion of an ovum already pathologic. In the cases complicated by pneumonia, the frequency of interruption of pregnancy is doubled, being 52 per cent. in 585 cases. If we disregard the first two months, the percentage is still higher, termination of pregnancy occurring in 62 per cent. of 308 cases. In view of the popular opinion that the presence of influenzal pneumonia nearly always causes an interruption of pregnancy, it is of interest to note the surprising fact that in 38 per cent. of the fatal cases cases the patients died without interruption of

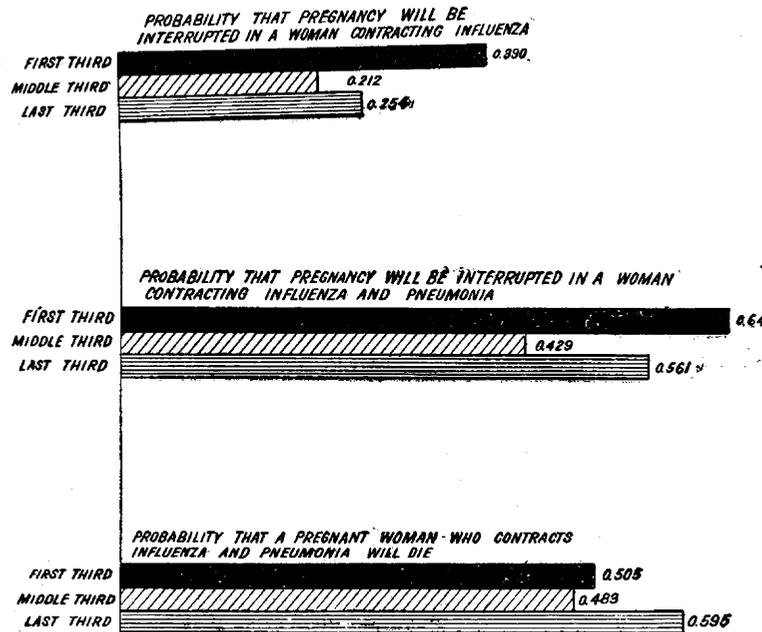
required in order to bring about the termination of pregnancy.

TABLE 5.—RELATION OF INTERRUPTION OF PREGNANCY TO MORTALITY

Month of Pregnancy	Pregnancy Not Interrupted			Pregnancy Interrupted		
	Cases	Deaths	Percentage of Mortality	Cases	Deaths	Percentage of Mortality
1.....	6	6	1	17
2.....	34	5	15	50	9	18
3.....	69	10	15	57	26	46
4.....	98	13	13	60	25	41
5.....	105	21	20	47	22	47
6.....	128	20	16	54	25	46
7.....	152	28	18	83	39	47
8.....	149	20	13	111	44	40
Total.....	743	117	16	468	191	41

The reverse of Table 4 is presented in Table 5, in which the data are so arranged as to show the effect of abortion and premature labor on the incidence of mortality. In 743 patients in whom pregnancy was not

interrupted, there was a mortality of 16 per cent. In 468 cases in which there was termination of pregnancy, the mortality was 41 per cent. This distinctly higher percentage is consistent throughout the different stages of pregnancy with the exception of the first two months; but, as already pointed out, the number of cases in those months is too small to warrant any definite conclusions. It is plainly evident that the interruption of pregnancy renders the prognosis more grave. If we restrict our data to the cases that were complicated by pneumonia, it is found that in the 383



Probabilities with respect to pregnant women contracting influenza or influenzal pneumonia.

TABLE 4.—FREQUENCY OF INTERRUPTION OF PREGNANCY IN FATAL CASES

Month of Pregnancy	Number of Deaths Reported	Pregnancy Uninterrupted		Pregnancy Interrupted	
		No.	Per Cent.	No.	Per Cent.
1.....	1	1	100
2.....	14	5	36	9	64
3.....	36	10	28	26	72
4.....	38	13	34	25	66
5.....	43	21	49	22	51
6.....	45	20	44	25	56
7.....	67	28	42	39	58
8.....	64	20	31	44	69
Total.....	308	117	38	191	62

pregnancy. This would indicate that when the ovum and the placentation are normal, an extremely severe disturbance in the condition of the mother may be

cases in which pregnancy was not interrupted, the mortality was 41 per cent.; whereas in 395 cases in which pregnancy was interrupted there was a mortality of 63 per cent.

It may be of interest to present the same statistics in another form, which has certain advantages from the point of view of accurate comparisons. One can calculate the mathematical probability of certain types of occurrence in the general "universe of discourse" comprehended by these statistics. By elementary theory of probability, it is known that if an event may happen only in one or the other of two ways, *a* and *b*, and in *n* trials it actually happens *m* times in one particular way, *a*, then the probability (*p*) of its occurrence in that way may be thus expressed: $p = \frac{m}{n}$, and the probability (*q*) of its occurrence in the other way, *b*, would be expressed $q = 1 - p$.

Applying this principle to the present statistics, and grouping the material, we get the results shown in Tables 6, 7 and 8, and in the chart, which have been

prepared for me through the kindness of Dr. Raymond Pearl of the School of Hygiene and Public Health.

From these tables we note that, so far as may be judged from the present statistics, the chances of the interruption of pregnancy are about doubled if the woman contracts both influenza and pneumonia, over what they are if she has influenza alone. It is the general impression of obstetricians that normally, and without known complications, the chance is about 1:5

TABLE 6.—DEGREE OF PROBABILITY THAT THE PREGNANCY OF A WOMAN WHO CONTRACTS INFLUENZA UNCOMPLICATED BY PNEUMONIA WILL BE INTERRUPTED

If the Influenza Attack Is in the:	Probability of Interruption	Chance of Interruption Is One in:
First third of pregnancy.....	0.390 ± 0.03	2.6
Middle third of pregnancy.....	0.212 ± 0.018	4.7
Seventh and eighth months of pregnancy	0.254 ± 0.018	3.9

that pregnancy will be interrupted. The data in Table 6 indicate that the normal chance of the interruption of pregnancy is not greatly increased by the presence of influenza alone. The chance of death from influenza complicated by pneumonia is obviously greatly increased by the interruption of pregnancy.

As this paper was about to be submitted for publication, two others appeared, dealing with the statistical relation of influenza to pregnancy. Bland¹ reports 337 cases. In a study of 200 of these he gives a mor-

TABLE 7.—DEGREE OF PROBABILITY THAT THE PREGNANCY OF A WOMAN WHO CONTRACTS INFLUENZA AND PNEUMONIA WILL BE INTERRUPTED

If the Influenza Attack Is in the:	Probability of Interruption	Chance of Interruption Is One in:
First third of pregnancy.....	0.644 ± 0.032	1.6
Middle third of pregnancy.....	0.429 ± 0.021	2.3
Seventh and eighth months of pregnancy	0.561 ± 0.022	1.8

tality of 49 per cent. This is somewhat higher than is yielded by our larger number of cases in which, as has been seen, we have a total mortality of 27 per cent. As to the effect of the disease on pregnancy, Bland reports the interruption of pregnancy in 58 per cent. of his cases, a figure considerably higher than that shown by our data, which is 39 per cent. in 1,211 cases falling within the first eight months.

Attention may also be called to the paper of Kosmak,² in which is given a summary of twenty-one

TABLE 8.—DEGREE OF PROBABILITY THAT A PREGNANT WOMAN WHO CONTRACTS INFLUENZA AND PNEUMONIA WILL DIE

If the Influenza Attack Is in the:	Probability of Death	Chance of Death Is One in:
First third of pregnancy.....	0.505 ± 0.034	2.0
Middle third of pregnancy.....	0.483 ± 0.021	2.1
Last third of pregnancy and at term.....	0.595 ± 0.019	1.7

hospital cases studied by him, in addition to several private cases. This author has kindly permitted me to use his data, and they are incorporated in the foregoing statistics.

RESULTS OF THE STUDY

It is assumed that the 1,350 cases on which these statistics are based were serious enough to require medical attention, and do not include the very mild

cases; nor do they include many of the cases falling within the first two months of pregnancy, when gestation might easily escape the knowledge of the physician. With these reservations, the results of the study are as follows:

1. Pneumonia complicated the influenza in about one half of the pregnant women here reported.

2. In the cases complicated by pneumonia, about 50 per cent. of the patients died, the mortality being somewhat greater during the last three months of pregnancy.

3. The gross mortality of all cases was 27 per cent.

4. Pregnancy was interrupted in 26 per cent. of the uncomplicated cases, and in 52 per cent. of the cases accompanied by pneumonia. In the cases ending fatally, abortion or premature labor occurred in 62 per cent. Thus, in 38 per cent. of the fatal cases the patient died without interruption of pregnancy.

5. The mortality of influenza was considerably higher (41 per cent.) in the cases complicated by abortion or premature labor than in those in which pregnancy was uninterrupted (16 per cent.).

INFLUENZA IN A NEWLY BORN INFANT

REPORT OF A CASE

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Through the kindness of Dr. David S. Hillis of the Chicago Lying-In Hospital, I was permitted to examine a newly born infant whose mother showed symptoms of influenza one day previous to labor. In order to make clear the condition of the baby, I will include the history of the mother's illness, furnished by Dr. Hillis.

REPORT OF CASE

History.—Mrs. J., aged 26, a primipara, developed symptoms of influenza late in the afternoon of December 27, when she was within two weeks of term. The symptoms were cough, fever, chilliness, headache and backache, with much soreness in the chest. She had had no sleep during the night.

Labor pains were first noticed at 6 a. m., December 28. Influenza symptoms continued. At 2:30 p. m. the temperature was 101.2 and the patient was in active labor: The fetal heart tones were more rapid than usual, being 150 throughout labor, but they were always regular and not of a character to indicate mechanical disturbance of fetal circulation. Labor continued normally, and at 12:30 a. m., December 29 the bag of waters appeared at the vulva and was artificially ruptured. The liquor amnii was markedly stained with meconium. At 12:46 there was spontaneous delivery of a boy, whose weight was 6 pounds, 12 ounces.

The infant's skin became grayish blue almost immediately after birth, and this condition persisted in spite of vigorous crying and clear air passages. The baby seemed vigorous at birth and breathed promptly after delivery. Auscultation of the baby's chest ten minutes after birth revealed many fine moist râles in both lungs, but there was no dullness on percussion. The following day, December 29, at 10 a. m., the baby was put to the breast and nursed well. Shortly after this, however, the breathing became labored and rapid. At 11 p. m. of this day, the respiration rate was 120. The temperature was not high, never exceeding 100, and falling to 97 F. The baby became more and more cyanotic. Respirations were superficial and rapid. Occasionally the infant uttered a weak cry.

The examination of the baby's blood made on the day before death showed a white count of 21,450 with a few

1. Bland, P. B.: Influenza in Its Relation to Pregnancy and Labor, Am. J. Obst. 79: 184, 1919.

2. Kosmak, G. W.: The Occurrence of Epidemic Influenza in Pregnancy, Am. J. Obst. 79: 238, 1919.