

A careful review of one county's hospital records contributes to the limited knowledge of the pattern of fetal and early neonatal loss and provides information about the adequacy of registration and the medical use of terminology.

Fetal and Early Neonatal Deaths in Onondaga County, New York

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IN COMPARISON with infant and later mortality, relatively little is known about the incidence of fetal mortality, especially deaths occurring during the early months of gestation. Most information on fetal mortality relates to deaths occurring after 20 weeks of gestation. There are many reports on fetal mortality in individual hospitals, but these have the major drawback of possible selection of patients unrepresentative of the population as a whole. In a few areas, such as in New York City, reporting of fetal deaths at any stage of gestation is required. Since the responsibility for reporting fetal deaths in such an area rests mainly with the hospitals, the extent of possible under-reporting is difficult to ascertain.

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As one attempt to make up for these deficiencies, information has been obtained on fetal mortality covering an entire geographic area—Onondaga County, N.Y.—from a direct study of original hospital records. Although this method includes only fetal deaths requiring hospitalization of the mother, it does obviate the factor of selection of patients present in studies in individual hospitals. Furthermore, it permits comparison with data for New York City, where all but a negligible number of the fetal death reports emanate from hospitals.

The primary objective of the study was to obtain as complete a picture as possible, from a review of hospital records, of the incidence of fetal losses occurring in 1951 and 1952 among residents of Onondaga County who were hospitalized in the county. Neonatal deaths occurring during the first 24 hours after birth in the same years were included also because of the possible difficulty in distinguishing fetal deaths occurring immediately before or during birth from neonatal deaths occurring immediately after birth. A secondary objective was the exploration of such questions as the accuracy of the period of gestation reported on the stillbirth certificate and the completeness of re-

porting of stillbirths (or fetal deaths occurring after a gestation period of 20 or more weeks, as defined for purposes of reporting in New York State) as compared with information from the hospital records.

Method

Onondaga County was selected for the study for several reasons. Its population, 342,000 at the time of the 1950 census, provided a large enough base for the development of significant rates. More than half the county's population was concentrated in Syracuse, the county seat and only city, which also was its trade center and center for medical and hospital care. Furthermore, all the hospitals in the county were located in Syracuse, and all but about 0.5 percent of the recorded births in the county occurred in these hospitals. Only 5 percent of the births to Onondaga County residents were recorded outside the county.

Local facilities and the possibilities of local cooperation were even more important determinants in the selection of Onondaga County. The performance of many studies in problems relating to fetal and neonatal mortality by the Syracuse City Department of Health and by the departments of obstetrics and pediatrics at the Upstate Medical Center of the University of the State of New York, in Syracuse, tended to assure a receptive attitude on the part of the hospital authorities. The location of a medical school in Syracuse made it feasible to obtain students for a review of hospital records during the summer months between their third and fourth years of medical school.

Four medical students were assigned to the study with the aim of locating as many as possible of the hospital records of fetal and early neonatal deaths in 1951 and 1952. Cases were included in the study if the delivery occurred in a hospital or if the mother was hospitalized within 2 weeks after the event. Each medical student was assigned to one or more hospitals, where he reviewed the records and tabulated the information on schedules designed for the purpose.

A search was first conducted of the diagnostic files of the hospital, using a special guide based on the Standard Nomenclature of Dis-

eases and Operations (1). The hospital discharge diagnosis file was the principal source of cases. This file was supplemented by referral to the doctor's diagnosis card and any other available official hospital files of neonatal deaths, fetal deaths, and operations. Other supplemental sources, when available, included the pathology laboratory file of diagnoses on surgical specimens and autopsies, including those obtained from dilatation and curettage; obstetrics and gynecologic service admitting books; any special files compiled for use of obstetrics and gynecology staff; and information from specific studies.

Review of a patient's chart included examination of the physicians' and nurses' notes, especially at the time of admission and in the delivery or operating room. Each chart was searched also for pathology laboratory reports, special attention being given to reports of microscopic specimens for findings of decidual tissue or other evidence of pregnancy. No cases were included in the study purely on the basis of a history of a pregnancy which terminated previous to 2 weeks before hospital admission. The length of gestation in weeks was calculated directly from information obtained from hospital records.

The decision as to whether any case should be recorded as a fetal death or an early neonatal death depended on information pertaining to evidence of life on the hospital records. Each fetal death was recorded, in accordance with the recommendation of the World Health Organization, as early (less than 20 completed weeks of gestation), intermediate (20 completed weeks

Table 1. Fetal and early neonatal mortality, Onondaga County, N.Y., 1951-52

Mortality index	1951	1952	1951-52
Fetal death ratio ¹ -----	87.1	90.5	88.9
Fetal death rate ² -----	80.2	83.0	81.6
Early neonatal death rate ³ -----	11.2	12.3	11.8
Fetal and early neonatal death rate ⁴ -----	90.5	94.3	92.4

¹ Fetal deaths per 1,000 live births.

² Fetal deaths per 1,000 live births and fetal deaths.

³ Early neonatal deaths (within 24 hours after birth) per 1,000 live births.

⁴ Fetal deaths and early neonatal deaths per 1,000 live births and fetal deaths.

Table 2. Distribution of fetal and early neonatal deaths according to the World Health Organization classification, Onondaga County, N.Y., 1951-52

Classification of deaths	Number	Percent
Total deaths.....	1, 707	100. 0
Fetal deaths.....	1, 456	85. 3
Early.....	985	¹ 67. 7
Intermediate.....	123	¹ 8. 4
Late.....	216	¹ 14. 8
Not stated.....	132	¹ 9. 1
Early neonatal deaths ²	193	11. 3
Period of death not stated.....	58	3. 4

¹ Percent of fetal deaths.

² Within 24 hours after birth.

of gestation but less than 28), late (28 completed weeks of gestation and over), or period of death not stated for a death that could not reasonably be classified. The physician's statement of the outcome (abortion, miscarriage, stillbirth, neonatal death, or not stated) was also recorded. Stillbirth and live birth certificates were reviewed, and the reported length of gestation was noted.

For residents of Syracuse the census tract in which the family resided was established, and mortality rates were related to the socioeconomic status of the tracts. Socioeconomic status was determined by using an index developed by Willie (2). This index is based on average monthly rental, market value of owned homes, proportion of detached single-family dwellings, median school years completed by adults 25 years of age or older, and the proportion of operatives, service workers, and laborers reported in the 1950 U.S. census. Six groups of census tracts were constituted, and were designated on a scale from I (high) to VI (low).

Results

The fetal and early neonatal death rates for each of the study years are given in table 1. For comparison with other areas, in which the ratio of fetal deaths to live births is used, rather than the ratio of fetal deaths to the total of live births and fetal deaths, the fetal death ratios are also given.

The number of fetal and neonatal deaths and the proportion of fetal deaths according to length of gestation, by the World Health Organization classification, are given in table 2. Sixty-eight percent of the 1,456 fetal deaths were classified as early, contrasted with 8.4 percent in the intermediate group and 14.8 percent in the late group; 9.1 percent could not be readily classified because of lack of information in the hospital records.

The only study which we have found to lend itself readily to comparison with the Onondaga County experience is one reported by Erhardt relating to New York City data for 1950 (3). As indicated previously, the New York City figures are based on reports submitted to the city department of health, rather than from a direct study of the hospital records. The type of material provided by the two studies is comparable, however, since the reports received in New York City emanate almost entirely from hospitals.

The proportions of classifiable fetal deaths in the early, intermediate, and late groups were very similar in the Onondaga County and New York City studies (table 3). The only marked

Table 3. Comparison of fetal deaths according to length of gestation, New York City, 1950, and Onondaga County, N.Y., 1951-52

Weeks of gestation	Number of fetal deaths		Percentage distribution ¹	
	Onondaga County	New York City	Onondaga County	New York City
0-19 (early).....	985	12, 255	74. 4	77. 0
0-3.....	23	85	1. 7	1. 5
4-7.....	89	2, 179	6. 7	13. 7
8-11.....	408	5, 620	30. 8	35. 3
12-15.....	333	2, 937	25. 2	18. 4
16-19.....	132	1, 434	10. 0	9. 0
20-27 (intermediate).....	123	1, 337	9. 3	8. 4
20-23.....	76	894	5. 7	5. 6
24-27.....	47	443	3. 5	2. 8
28 or more (late).....	216	2, 328	16. 3	14. 6
28-31.....	43	417	3. 2	2. 6
32-35.....	41	404	3. 1	2. 5
36-39.....	76	468	5. 7	2. 9
40 or more.....	56	1, 039	4. 2	6. 5
Unknown.....	132	485	-----	-----
Total.....	1, 456	16, 405	-----	-----

¹ Based on fetal death records from which length of gestation could be calculated.

Table 4. Fetal and early neonatal death rates by age of mother, Onondaga County, N.Y., 1951-52

Age of mother (years)	Fetal death rate ¹	Early neonatal death rate ²
Less than 20.....	55.4	11.7
20-24.....	67.0	9.9
25-29.....	69.8	9.8
30-34.....	90.7	11.3
35-39.....	130.7	20.6
40 or over.....	184.8	23.3

¹ Fetal deaths per 1,000 live births and fetal deaths.
² Deaths within 24 hours after birth per 1,000 live births.

differences in distribution of fetal deaths occurred in the breakdown of early fetal deaths by 4-week periods. The proportion of fetal deaths in the 4- to 7-week and the 8- to 11-week groups is higher in New York City. These differences were balanced by a higher proportion of deaths between 12 and 20 weeks of gestation in Onondaga County. Whether these differences are real or due simply to errors in reporting cannot be determined. If the latter, it would mean that there is a tendency for hospitals to report fetal deaths occurring before the 20th week of gestation as having a shorter gestation period than is actually the case, since the Onondaga County data are based on direct calculation of the length of gestation from data in the hospital records.

Table 5. Fetal and early neonatal death rates by socioeconomic status of census tract of family residence, Syracuse, N.Y., 1951-52

Socioeconomic status ¹	Number of census tracts	Fetal death rate ²	Early neonatal death rate ³
I.....	3	88.7	3.7
II.....	6	99.9	9.8
III.....	10	79.7	10.0
IV.....	11	92.6	10.0
V.....	12	93.6	13.6
VI.....	17	97.3	16.1

¹ I is highest, VI is lowest.
² Fetal deaths per 1,000 live births and fetal deaths.
³ Deaths within 24 hours after birth per 1,000 live births.

As shown by the data in table 4, the fetal death rate increased steadily with advancing age of the mother, with a sharp increase after age 35 years. The early neonatal death rate was definitely higher only in the groups aged 35 years and over. Since the number of early neonatal deaths is much smaller than that of fetal deaths, however, the variations in the early neonatal death rates are not as significant.

A crude index of the relationship of socioeconomic status and fetal and early neonatal mortality among Syracuse residents is presented in table 5. The census tracts are grouped by descending status from the highest in group I to the lowest in group VI. It should be emphasized that the considerable degree of variation in socioeconomic status within the census tracts may tend to reduce the sharpness of any differences among the various tracts. No trend in the fetal death rates is discernible with change in socioeconomic status. On the other hand, the early neonatal death rate, even though based on smaller numbers, shows a distinct increase with decline in socioeconomic status.

Table 6 shows the extent of agreement, within 2 weeks, of the length of gestation as calculated from 382 hospital records with that stated on

Table 6. Extent of agreement, within 2 weeks, of length of gestation reported on hospital records and on stillbirth and birth certificates, Onondaga County, N.Y., 1951-52

Weeks of gestation reported on hospital record	Fetal deaths		Early neonatal deaths ¹	
	Number	Percent agreement with vital record	Number	Percent agreement with vital record
Total deaths registered.....	228	64.9	154	65.6
Less than 20 ²	1	-----	5	60.0
20-23.....	16	75.0	24	62.5
24-27.....	28	53.6	41	56.1
28-31.....	31	48.4	16	68.8
32-35.....	33	69.7	10	60.0
36-41.....	102	73.5	46	80.4
42 or more.....	17	41.2	12	50.0

¹ Within 24 hours after birth.
² Stillbirth certificate not required.

Table 7. Extent and kind of vital registration compared with the World Health Organization classification of deaths, Onondaga County, N.Y., 1951-52

Classification of deaths	Total	Vital record filed		
		None	Still-birth certificate	Birth and death certificates
Total deaths.....	1, 707	1, 230	284	193
Early fetal death ¹	985	983	1	1
Intermediate fetal death.....	123	71	52	0
Late fetal death.....	216	14	202	0
Fetal death, group not classifiable.....	132	117	15	0
Early neonatal death ²	193	4	2	187
Death not classifiable.....	58	41	12	5

¹ Stillbirth certificate not required.

² Within 24 hours after birth.

stillbirth and live birth certificates. (Only fetal deaths after 20 or more weeks of gestation are reportable in New York State outside New York City.) Among both the fetal deaths and the early neonatal deaths there is about two-thirds agreement. There appears to be greater agreement at and around term than at other periods of gestation.

An analysis of the extent and kind of vital registration according to the World Health Organization classification of deaths is presented in table 7. The greatest degree of under-registration among the deaths for which reporting is mandated was found among the intermediate fetal deaths. In this group, stillbirth certificates were filed for only 52 out of 123, or 42 percent of the deaths. Among the 216 late fetal deaths, 94 percent were registered as stillbirths. Of the 194 early neonatal deaths, 97 percent were registered as births and deaths, 1 percent were registered as stillbirths, and 2 percent were not registered.

Comparison of evidence of life found in hospital records with the kind of vital record filed revealed a close correspondence between the two (table 8). Of the deaths with evidence of life indicated in the hospital record, all but six had birth and death certificates filed. Among

these six, there were two registered as stillbirths. One of these, at 22 weeks' gestation, was stated to have had a detectable heartbeat for several minutes. The other, surprisingly, had a calculated length of gestation of 40 weeks and was stated to have lived for 7 hours.

There were four deaths with recorded evidence of life which were not registered. Every one of these had periods of gestation of less than 20 weeks, and in each instance the evidence of life after delivery was fleeting. The large number of instances in which there was no specific reference on the hospital record to presence or absence of life is rather striking.

The relationship between the physician's statement of the outcome of pregnancy in clinical terms to the outcome according to the World Health Organization classification was the final point investigated. Roughly, the term "abortus" or "abortion" corresponds to early fetal death, "miscarriage" to intermediate fetal death, and "stillbirth" to late fetal death. Comparison revealed the greatest degree of agreement, 92 percent, between the physician's statement of abortion and early fetal deaths among those classifiable by the World Health Organization's definitions (table 9). Agreement between the use of the term "stillbirth" and the classification as late fetal death, 82 percent, was less, but only in the use of the term "miscarriage" was there a gross discrepancy. Only 5 out of 23 deaths called miscarriages with calculable periods of gestation, or 22 percent, fell within the limits for intermediate fetal deaths. Fourteen, or 61 percent, corresponded to early fetal deaths, and 4, or 17 percent, to late

Table 8. Relation between evidence of life and extent and kind of vital registration, Onondaga County, N.Y., 1951-52

Vital record filed	Total	Evidence of life		
		No	Yes	Not stated
Total deaths.....	1, 707	1, 147	185	375
None.....	1, 230	919	4	307
Stillbirth certificate.....	284	227	2	55
Birth and death certificates.....	193	1	179	13

Table 9. Physician's statement of outcome compared with World Health Organization classification of deaths, Onondaga County, N.Y., 1951-52

Classification of deaths	Total	Physician's statement					
		Abortion	Miscarriage	Stillbirth	Neonatal death	Other	Not stated
Total deaths	1, 707	1, 142	43	265	187	49	21
Early fetal death	985	925	14	1	0	41	4
Intermediate fetal death	123	74	5	43	0	1	0
Late fetal death	216	10	4	201	0	0	1
Fetal death, group not classifiable.	132	94	15	15	0	6	2
Early neonatal death ¹	194	4	0	2	187	0	0
Death not classifiable	58	35	5	3	0	1	14

¹ Within 24 hours after birth.

fetal deaths. A larger proportion of deaths termed miscarriages were not classifiable by World Health Organization definition than either abortions or stillbirths.

Summary

A study was made of 1951 and 1952 hospital records in Onondaga County, N.Y., to determine the incidence of fetal and early neonatal losses.

Of the total of 1,456 fetal deaths, 67.7 percent occurred before 20 weeks of gestation, 8.4 percent between 20 weeks and 28 weeks, and 14.8 percent after 28 weeks; 9.1 percent could not be readily classified. The proportions of classifiable fetal deaths in the early, intermediate, and late groups were very similar to those found in New York City studies based on reports to the city health department.

The fetal death rates and, to a lesser extent, the early neonatal death rates increased with advancing age of the mother. No trend was discernible in the fetal deaths with change in socioeconomic status of the census tract of family residence, but the early neonatal death rate was inversely related to socioeconomic status.

Agreement between the length of gestation calculated from the hospital records and that stated on the registration forms was about two-thirds for both fetal and early neonatal deaths. Under-registration was greatest for the intermediate fetal deaths, with only 42 percent of such deaths registered. Only 6 out of 182 deaths with evidence of life indicated in the hospital records, however, did not have live birth and death certificates filed. In comparing the physician's statement of the outcome of pregnancy with the classification of the deaths according to the World Health Organization definitions, agreement was lowest between the term "miscarriage" and the corresponding classification of intermediate fetal death.

REFERENCES

- (1) Plunkett, R. J., and Hayden, A. C., Editors: Standard nomenclature of diseases and operations. Ed. 4. New York, Blakiston Co., 1952.
- (2) Willie, C. V.: Socio-economic and ethnic areas in Syracuse, New York. Unpublished doctoral dissertation. Syracuse, N.Y., Syracuse University, Department of Sociology and Anthropology, 1957.
- (3) Erhardt, C. L.: Reporting of fetal deaths in New York City. Pub. Health Rep. 67: 1161-1167, December 1952.