

A LIFE TABLE OF PREGNANCY TERMINATIONS AND CORRELATES OF FETAL LOSS

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WE are now in the midst of the most determined and energetic efforts ever exerted in this country to identify the correlates of pregnancy loss and childhood disorders that have their etiology in prenatal circumstances. The need for this concerted attack is clear. It has been suspected that 15–20 per cent of pregnancies end in fetal deaths, perhaps 4–6 per cent of all offspring have a major or minor congenital anomaly that becomes manifest in early childhood, and an undetermined proportion of children have other disorders that may be related to conditions present during pregnancy and to the birth process.

Although a few pioneering studies have thrown some light on the magnitude and circumstances associated with pregnancy loss and damage to the offspring, it is generally agreed that we are still in a primitive stage of knowledge on these matters. Hope for a significant advance undoubtedly rests in part on the accumulation of knowledge from a variety of epidemiological studies directed at different types of population groups and conducted with varying methodologies and degrees of intensity.

This paper is concerned with partial findings in one such project. In 1958, with the support of the Association for the Aid of Crippled Children, the Commonwealth Fund and the Milbank Memorial Fund, an investigation of the relationship between maternal morbidity and pregnancy outcome was initiated based on the medical records of members of the Health Insurance Plan of Greater New York. The conditions for which women receive medical care prior to conception and during pregnancy are being related to the occurrence of fetal

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mortality, prematurity, congenital anomalies and other morbid conditions that appear in the first two years after birth.

Because of the special opportunities to identify pregnancies that terminate in the early weeks of gestation, the study also has as one of its important specific objectives the measurement of fetal loss at various stages of pregnancy and the re-examination of the relationship of the age of the mother, gravidity and prior pregnancy experience to fetal mortality, with particular emphasis on early pregnancy loss. This phase of the research has been completed for a segment of the two-year cohort under study, and is the subject of the current paper. One would like to assess simultaneously the role of maternal morbidity, but this will come later. In a sense, the data now available provide the background for the future introduction of little explored variables.

STUDY SETTING

The study is being conducted by HIP with the active cooperation of the 32 medical groups associated with it. Through these medical groups, members receive on a prepaid basis comprehensive medical care in the office, home and hospital from family physicians and specialists. Patients with an obstetrical or gynecological condition are referred to and obtain their care from obstetricians-gynecologists in the medical groups.

The medical care practices of members of HIP represent advantages for the current investigation. Prior studies have suggested that HIP enrollees have a somewhat lower threshold for recognizing illness, and visit physicians a little earlier in the course of acute illness than do others in the general community.² During the year 75 per cent of the HIP members see a doctor as compared with a corresponding figure of 67 per cent for urban residents in the United States. Finally, and of special significance, is the fact that two-thirds of the pregnant women in HIP start their prenatal care during the first trimester of

² HEALTH AND MEDICAL CARE IN NEW YORK CITY. (A Report by the Committee for the Special Research Project in the Health Insurance Plan of Greater New York. [New York: The Commonwealth Fund, 1957]), chapters V and X.

pregnancy. All of these circumstances are encouraging evidence of the opportunity to have under medical observation the great majority of pregnant women, and of the likelihood of identifying early terminations of pregnancy.

Another finding relevant to the interpretation of the data presented is that the prematurity and perinatal mortality rates in HIP are lower than the corresponding rates among patients of private physicians in New York City.³ However, as discussed later, associations between late fetal deaths and such variables as age of mother and gravidity are similar for the HIP study group and for the population at large. Accordingly, relationships found in the pregnancy study under way in HIP may well be indicative of the situation in the more general population.

Methodology and Definition. Included in the study reported here are the pregnancy terminations among women whose last menstrual period prior to pregnancy began in the interval March 1, 1958 through February 28, 1959 and who received care from HIP obstetricians in medical groups located in New York City. This totals 6,844 pregnancies. Excluded at this time because of special procedural problems are pregnant women living in Nassau and Columbia counties. The final results of the investigation will include these women and a second year's cohort of women with LMP's from March 1, 1959 through February 29, 1960. The two year experience will involve about 15,000 pregnancies.

The basic sources of information for the current study were routine reports of medical care rendered HIP members by HIP physicians and the medical charts of the obstetricians. As discussed in detail in the Appendix, these records identified the pregnant women and provided data on gestation age, gravida, age of mother, outcome and interval since last pregnancy. Certificates on file in the New York City Health Department

³ Sam Shapiro, Harold Jacobziner, Paul M. Densen and Louis Weiner: Further Observations on Prematurity and Perinatal Mortality in a General Population of a Prepaid Group Practice Medical Care Plan, *American Journal of Public Health*, Vol. L: 9 (September, 1960), pp. 1304-1317.

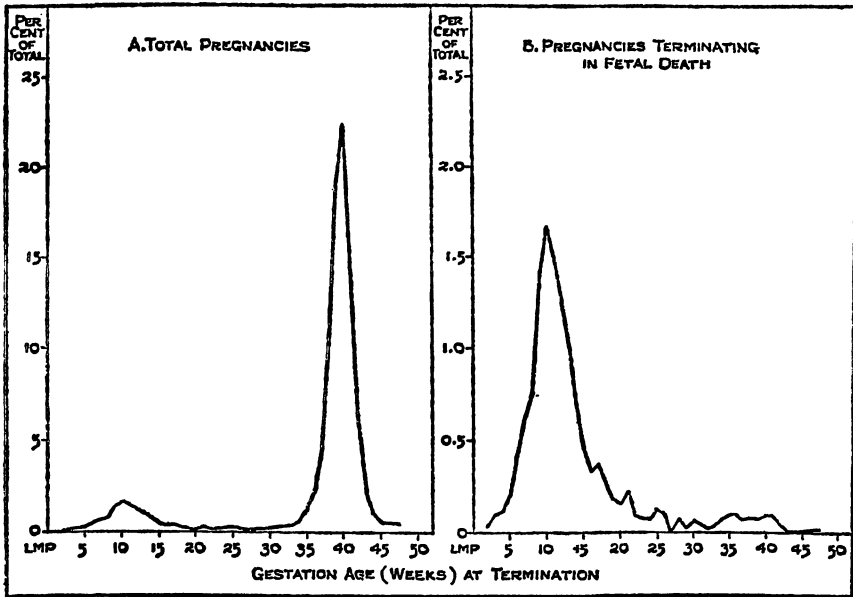


Fig. 1. Percentage distribution of pregnancies by gestation age at termination.

were checked to confirm the assignment of a pregnancy termination to the category "fetal death." In the case of an early fetal death for which no certificate could be located, a woman was judged to have been pregnant if one of the following criteria were met: microscopic findings indicating pregnancy, positive AZ test or definitive clinical diagnosis.

Gestation age was defined as the interval between the first day of the woman's last menses and the expulsion of the fetus, fetal, placental or decidual tissue. This provided a consistent basis for calculating the duration of pregnancy, although it did mean that for missed abortions particularly, the gestational age obtained was several weeks longer than the interval between LMP and fetal death. (See Appendix for analysis of effect this approach has on gestation age distributions).

FINDINGS

Pregnancy Termination by Week of Gestation Age. In Figs. 1 and 2, the probability of a pregnancy terminating in specified

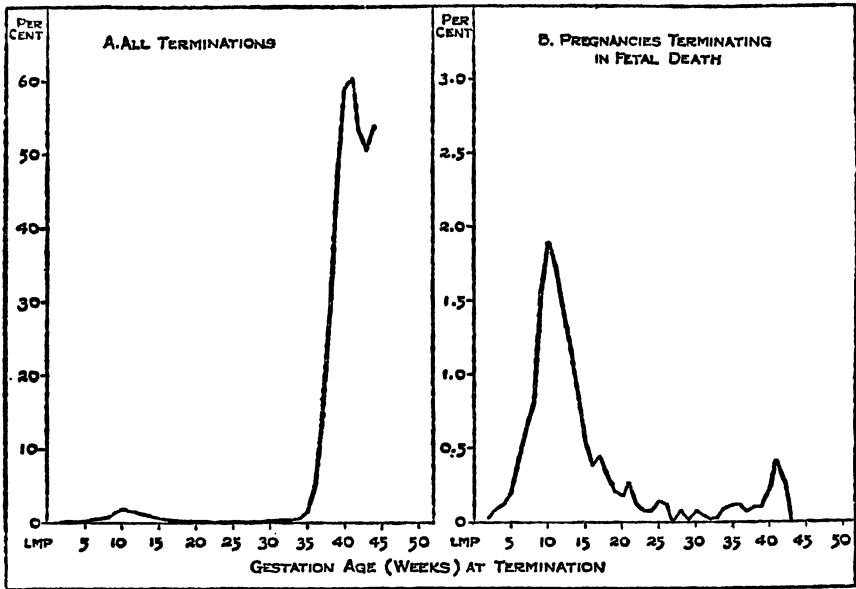


Fig. 2. Percentage of pregnancies reaching specified week of gestation age that terminate during the week.

weeks of gestation is examined in two ways.⁴ Figure 1 gives the percentage distribution of pregnancies by gestation age at termination. The points plotted are equivalent to d_x values in a life table and each represents the probability in a cohort of new pregnancies that a pregnancy will end in either a fetal death or live birth at specified weeks of gestation age. In the current study these probabilities form a bimodal distribution with an initial peak at 10 weeks and a second much higher peak at 40 weeks. The distribution has the appearance of two normal curves joined in the interval 20–27 weeks gestation (Fig. 1A). The portion of the curve to the left of this interval covers the period of embryonic and fetal development up to the point generally considered to be the beginning of fetal viability. All but about 12 per cent of the total number of fetal deaths is contained in the period prior to 20 weeks.

To obtain a clearer picture of the segment of the pregnancies that end in fetal death, the number of fetal deaths as a per-

⁴ See Appendix Table VI A for frequencies and percentages on which these figures are based.

centage of total pregnancies is plotted in Fig. 1B by weeks of gestation, using a scale 10 times larger than in Fig. 1A. It will be noted that the percentages increase greatly to reach a high at 10 weeks gestation and then decrease again sharply until around 20 weeks, after which they remain at a comparatively low point.

The probability that a pregnancy reaching a particular week of gestation will terminate in that week (i.e. the q_x value in a life table) is presented in Fig. 2. Although this differs in meaning from the probabilities in Fig. 1, the curves in the two charts are very similar until about the 36th or 37th week of gestation. From this period on, the rate of termination of pregnancies that have advanced to a particular gestation week increases greatly from one week to the next and is at its peak at about 41 or 42 weeks gestation. (Figure 2A). Close to 60 per cent of the women who have completed their 41st week of gestation deliver in the following week; 60 per cent of the remaining women deliver during the next week; and in each of the next 3 or 4 weeks there is about a 50-50 chance that the women will give birth. From Fig. 2B, which is restricted to fetal deaths, it would appear that after about 39 weeks gestation there is some increase in the likelihood that pregnancy will end in a fetal death. In view of the small numbers involved, this must be viewed as highly tentative, particularly with regard to the specific week in which the upturn occurs.

There is probably little reason to question the general form of the distributions in Figs. 1 and 2, except for the early gestation ages. The curve covering the period when live births predominate (i.e. after 28 weeks gestation) is similar to the one Taback⁵ obtained a number of years ago and would undoubtedly be repeated in any series of data for a general population group in which gestation age is calculated from the date of last menses. In the HIP setting, it would also seem reasonable for the portion of the curve that extends back to 10 weeks gesta-

⁵ Mathew Taback, Birth Weight and Length of Gestation with Relation to Prematurity, *Journal of the American Medical Association*, CLXXVI (July 7, 1961), pp. 890-901.

tion to be an accurate reflection of the true state of affairs.

But, what about the period prior to 10 weeks? Here considerably greater caution is required. It may be fair to say that the curves shown represent the total knowledge that physicians have about the occurrence and termination of pregnancy without regard to whether or not a certificate is on file in the Health Department. For HIP, this may come close to covering all pregnancies known to the women themselves that are not terminated through illegal abortion. However, the frequency with which women become pregnant and expel the products of conception without having been aware of their pregnant state remains, of course, unknown. And, it might be added, *will* remain unknown in any large scale study.

Although it is generally acknowledged that the observed probabilities of pregnancy termination in the very early weeks of gestation are too low, there are some circumstances that suggest they may not be gross understatements. Potter⁶ points out that the "embryonic sac develops normally only where it contains an embryo, but it may actually grow for about three months with a very abnormal embryo or none at all," and then concludes that "more abortions occur at 10 to 14 weeks than at any other time." The last is, of course, a speculation since there are no data free of the problems discussed.

It should be borne in mind, also, that the end point for measuring gestation age in studies of fetal loss is the date of expulsion of fetal or placental tissue. In missed abortions this will be several weeks longer than the interval between LMP and the death of the fetus *in utero*. (This limitation applies to all periods of gestation). The beginning point for calculating gestation age also introduces an artifact. Since the first day of last menses is used for the calculation, the actual interval between conception and pregnancy termination may be 1 to 3 weeks less than the gestation age shown. Taking this fact into consideration reduces the period of great uncertainty in measuring fetal loss from the first 10 weeks to the first 7 or 8 weeks.

⁶ Edith L. Potter, *The Abortion Problem*, GP, (April, 1959).

Rate of Fetal Loss. In the present study there were 142 fetal deaths per 1,000 pregnancies.⁷ Almost half of the fetal deaths (48 per cent) were at gestation ages under 12 weeks; another 32 per cent were at ages 12–19 weeks and 12 per cent at 20 weeks or more gestation (Table 1).⁹ In terms of rates the loss under 12 weeks represents 68 fetal deaths per 1,000 pregnancies. The corresponding figure at 12–19 weeks is 49 per 1,000 and at 20 weeks or more, it is 19 per 1,000.

The state of specific knowledge about the etiology of fetal loss is perhaps greatest for the 20 weeks or more group, but even here the information is only fragmentary. One of the major questions is the extent to which environmental and

Table 1. Percentage distribution of fetal deaths and fetal deaths per 1,000 pregnancies, by gestation age at termination of pregnancy.

GESTATION AGE AT TERMINATION OF PREGNANCY	FETAL DEATHS		FETAL DEATHS PER 1,000 PREGNANCIES ¹
	Number	Per Cent	
ALL AGES	970	100.0	141.7
Under 12 Weeks, Total	465	47.9	67.9
Under 4 Weeks	8	0.8	1.2
4–7 Weeks	92	9.5	13.5
8–11 Weeks	365	37.6	54.1
12–19 Weeks, Total	312	32.2	48.9
12–15 Weeks	234	24.1	36.7
16–19 Weeks	78	8.0	12.7
20 Weeks or More, Total	118	12.2	19.4
20–27 Weeks	56	5.8	9.2
28 Weeks or More	62	6.4	10.3
Not Stated	75	7.7	...

¹ Rates specific for each gestation age are based on the number of pregnancies remaining in the cohort at the specified age (total number of pregnancies less the number terminating prior to specified age); therefore, the age-specific rates do not add to the rate for all ages.

⁷ Preliminary indications are that for about a third of these fetal deaths, no certificates are on file in the New York City Department of Health. For New York City as a whole, an estimate of under-registration was made by Baumgartner, *et al.*,⁸ during the 1940s, and at that time the figure was close to 50 per cent.

⁸ Leona Baumgartner, H. M. Wallace, E. Landsberg and V. Pessin, The Inadequacy of Routine Reporting of Fetal Deaths, *American Journal of Public Health*, xxxix (December, 1949), pp. 1549–1552.

⁹ For about 8 per cent of the fetal deaths, the LMP could not be determined.

biological factors change in their relative importance in causing fetal deaths as gestation age increases. Yerushalmy, *et al.*¹⁰ in their published findings on the Kauai study speculate that "as we progress along the age scale from conception to birth, through infancy to childhood, the effect of environmental factors probably increases, while the effect of such biological factors as may be operating to contribute to death may be decreasing." The hypothesis has a ring of reasonableness; but other hypotheses may be advanced for fetal loss, including the possibility that after the very first few weeks of gestation, biological and environmental factors retain their same relative importance but that they operate at a lower lethal level.

A comprehensive exploration of the issue is beyond the scope of this paper. However, the analysis that follows is concerned with the relationship to fetal loss of a number of variables already implicated (i.e., age of pregnant woman, gravidity, outcome of last pregnancy and year of last pregnancy). The approach parallels in some ways that taken by other investigators. But in the HIP material the comparatively early period of gestation (under 12 weeks) is isolated for separate discussion, and the data probably refers to all fetal deaths that come to the attention of physicians.

Fetal Loss by Age of Mother and Gravidity. The rate of total fetal loss increases sharply from one age group of mothers to the next after the age 20 is passed (Table 2).¹¹ Among women 35 years or older the rate (219 per 1,000) is more than twice the figure for women 20-24 years of age (97 per 1,000). The difference between high and low rates is large in each of the three gestation age periods shown in Table 2. But there is some suggestion that the range is relatively greater under 12

¹⁰ J. Yerushalmy, Jessie Bierman, Dorothy H. Kemp, Angie Connor and Fern E. French: Longitudinal Studies of Pregnancy on the Island of Kauai, Territory of Hawaii, Part 1, Analysis of Previous Reproductive History, *American Journal of Obstetrics and Gynecology*, LXXI, 1 (January, 1956), pp. 89-96.

¹¹ The total fetal loss rate at ages under 20 is 124 per 1,000 pregnancies. This rate is subject to considerable variation because of the small number of cases, but the fact that it is higher than the rate of women 20-24 has its parallel in vital statistics data for the loss at 20 weeks or more gestation.

weeks than later. Another point of interest is that in all of the gestation periods the risk changes less between the age groups 20-24 and 25-29 years than between any other age groups.

Table 2 also gives fetal loss rates by gravidity. It will be observed that a direct relationship exists between gravidity and the rate of total fetal mortality. Women pregnant for the first time have only half the rate found among women with gravidity of 4 or more. This pattern does not hold for fetal loss at all gestation ages. During the period of 20 weeks or more gestation, the fetal loss rate among primigravidae is higher than among gravida 2 women, after which the rate starts to increase. This curvilinear relationship is consistent with vital statistics data.¹² At gestation ages 12-19 weeks there is no difference between the rates for gravida 1 and 2 women, and it is

Table 2. Fetal loss at specified gestation ages by age of mother and by gravidity.

AGE OF MOTHER AND GRAVIDITY	TOTAL PREGNANCIES ²	FETAL DEATHS PER 1,000 PREGNANCIES ¹			
		Gestation Age at Termination of Pregnancy			
		Total	Under 12 Weeks	12-19 Weeks	20 Weeks or More
TOTAL ²	6,844	141.7	67.9	48.9	19.4
<i>Age of Mother (at LMP)</i>					
Under 20 Years	161	124.2	*	*	*
20-24 Years	1,385	96.8	40.4	40.6	14.9
25-29 Years	2,222	115.2	52.2	39.9	16.3
30-34 Years	1,812	156.2	71.7	57.7	20.2
35 Years or More	1,190	219.3	120.2	64.9	29.6
<i>Gravidity</i>					
1	1,504	97.1	41.9	36.1	17.3
2	1,869	107.0	55.1	35.7	14.1
3	1,499	138.1	63.4	56.3	18.9
4 or More	1,898	186.5	93.3	62.8	27.3

¹ Rates specific for gestation age are based on total number of pregnancies less the number terminating prior to specified age.

² Totals include pregnancies with age of mother, gravidity and/or gestation age not stated.

* Rate not calculated; fetal deaths number fewer than 15.

¹² National Office of Vital Statistics, VITAL STATISTICS OF THE UNITED STATES, 1957, Vol. 1 (Washington, D. C.: U. S. Government Printing Office, 1959).

only at the early ages that fetal loss seems to increase from gravida 1 to 2.

The data for a single year's pregnancies are insufficient to examine fetal loss by both age of mother and gravidity at various gestation ages. Table 3, however, gives such rates for total fetal loss. For each age group under 35 there is some indication of an increased risk of fetal death as gravidity increases, particularly into the higher orders of gravidity. For women over 35 the risk is especially high among the primigravidae, a finding that, again, is consistent with vital statistics for the more limited segment of fetal deaths they cover.

With an additional year's experience, the relative importance of gravidity and age of mother in fetal loss will be explored. In view of the current study's findings, a question of considerable significance is whether this differs for early fetal loss and for loss at 20 weeks or more gestation.

Fetal Loss By Outcome of Prior Pregnancies. The risk of fetal loss is closely related to the outcome of the last prior pregnancy.¹³ This is true of all orders of pregnancy for multi-

Table 3. Total fetal loss by age of mother and gravidity.

AGE OF MOTHER AT (LMP)	TOTAL PREGNANCIES ¹	FETAL DEATHS PER 1,000 PREGNANCIES			
		Gravidity of Mother			
		Total	1	2 and 3	4 or More
TOTAL, ALL AGES ²	6,844	141.7	97.1	120.8	186.5
Under 20	161	124.2	126.0 ²	*	—
20-24	1,385	96.8	79.7	92.4	215.2 ²
25-29	2,222	115.2	72.2	93.4	178.3
30-34	1,812	156.2	129.5	139.8	170.2
35 and Over	1,190	219.3	261.9	192.9	203.8

¹ Totals include pregnancies with age of mother and/or gravidity not stated.

² Rate subject to considerable chance variation; fetal deaths number 15-19.

* Rate not calculated; fetal deaths number fewer than 15.

¹³ The reader's attention is called to the fact that for 178 of the 970 pregnancies ending in fetal death, the outcome of the last pregnancy was not determined. The effect of the unknown should be minor in comparisons specific for gestation age, gravidity or age of mother.

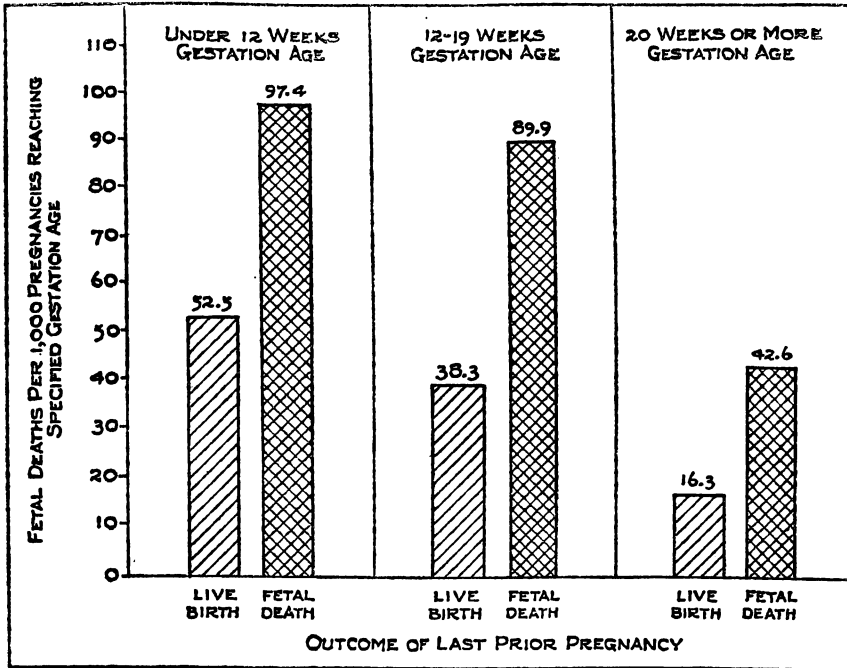


Fig. 3. Fetal loss at specified gestation ages by outcome of last prior pregnancy: multigravidae only.

Table 4. Fetal loss at specified gestation ages by outcome of last prior pregnancy.

OUTCOME OF LAST PRIOR PREGNANCY	TOTAL PREGNANCIES ²	FETAL DEATHS PER 1,000 PREGNANCIES ¹			
		Gestation Age at Termination of Pregnancy			
		Total	Under 12 Weeks	12-19 Weeks	20 Weeks or More
Total ²	6,844	141.7	67.9	48.9	19.4
No Prior Pregnancy	1,504	97.1	41.9	36.1	17.3
Last Pregnancy Live Birth	4,248	110.2	52.5	38.3	16.3
Last Pregnancy Fetal Death	801	222.2	97.4	89.9	42.6

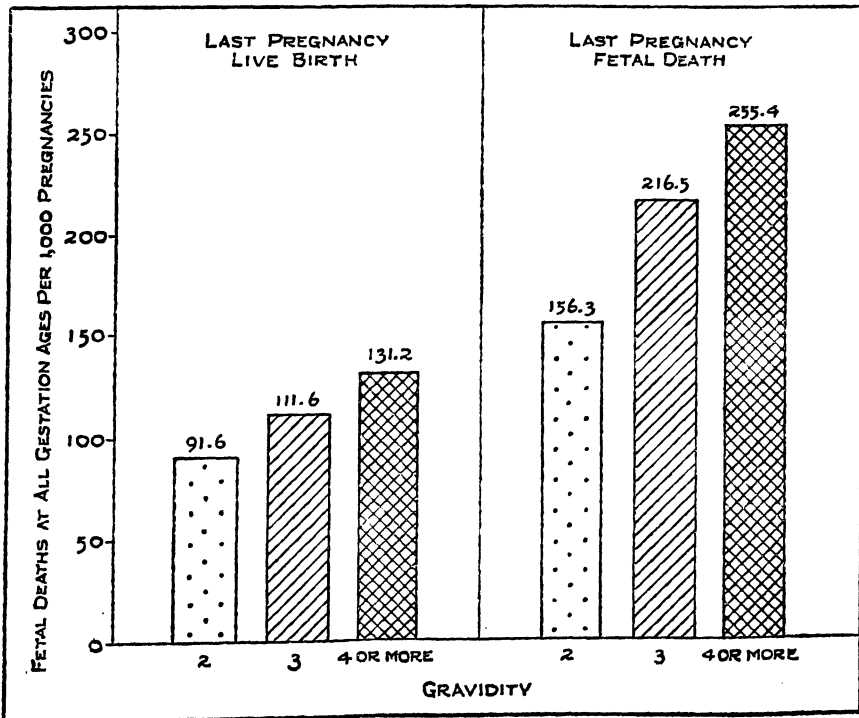
¹ Rates specific for gestation age are based on total number of pregnancies less the number terminating prior to specified age.

² Totals include pregnancies with outcome of last prior pregnancy not stated and/or gestation age not stated.

gravidae and the increased risk is found at each gestation age in the current pregnancy (Table 4 and Fig. 3). In general, the impression is that women whose previous pregnancies have ended in a fetal death have about twice as high a rate of fetal loss as those who had a live birth. The overall rates observed in this study for the two groups of women, respectively, are 222 and 110 fetal deaths per 1,000 pregnancies.

A point of special interest is that as gravidity increases, the loss rate among women who had a live birth in their previous pregnancy also rises. (Fig. 4 and Table 5). The relationship is quite similar for women whose prior pregnancy ended in a fetal death. This could occur either because of the change in gravidity itself (and its correlate, age of mother) or what may be at least as important, the accumulation from one gravidity to the next of women who have had increasing numbers of fetal

Fig. 4. Total fetal loss by outcome of last prior pregnancy and gravidity of mother: multigravidae only.



deaths. The increased risk of loss in future pregnancies associated with the number of prior losses has, of course, been observed in a number of studies.

The existence of a strong relationship between outcome of prior pregnancy and fetal loss in succeeding pregnancies is also evident at all ages of the mother (Table 6). There is, however, an association between age of mother and fetal outcome independent of the experience in the previous pregnancy. It will be noted that fetal death rates among women with a live birth just prior to the current pregnancy increase with increasing age of mother. Among women whose prior pregnancy ended in a fetal death, the fetal loss rates are similar for mothers in the two age groups under 30, but they are much higher for mothers 30 and older.

A basic question requiring further consideration is whether the associations with age of mother are only a reflection of changing gravidity. Joint consideration of age and gravidity

Table 5. Fetal loss by outcome of last prior pregnancy and gravidity of mother, for multigravidae only.

GRAVIDITY (MULTIGRAVIDAE ONLY)	OUTCOME OF LAST PRIOR PREGNANCY		
	Total ¹	Live Birth	Fetal Death
	FETAL DEATHS PER 1,000 PREGNANCIES		
2 and 3, Total	120.8	100.3	186.5
2	107.0	91.6	156.3
3	138.1	111.6	216.5
4 or More	186.5	131.2	255.4
	NUMBER OF PREGNANCIES ²		
2 and 3, Total	3,368	2,891	386
2	1,869	1,637	192
3	1,499	1,254	194
4 or More	1,898	1,357	415

¹ Totals include pregnancies with outcome of last prior pregnancy not stated.

² Excludes pregnancies with gravidity not stated.

would clarify this issue and will be possible when all of the data in the study become available.

Year of Last Prior Pregnancy. Interval between pregnancies has long been implicated in the risk of fetal loss. In the current study this issue has been examined in relation to the year in which the woman's last prior pregnancy terminated. While it may be assumed that interval between pregnancies¹⁴ is related to these years, it is well to bear in mind that there is some overlap when years are used. For example, the interval for women whose last prior pregnancy ended in 1958 may be anywhere from 1 or 2 months to 15 months; the interval for the 1957 group of women could be 3 to 27 months. The effect of this overlap would be to diminish differences related to interval between pregnancies. Despite this limitation, a number of useful observations can be made in the current study.

Figure 5A suggests that the fetal loss rate among women

Table 6. Fetal loss by outcome of last prior pregnancy and age of mother for multigravidae only.

AGE OF MOTHER AT LMP (MULTIGRAVIDAE ONLY) ¹	OUTCOME OF LAST PRIOR PREGNANCY		
	Total ²	Live Birth	Fetal Death
	FETAL DEATHS PER 1,000 PREGNANCIES		
20-24 Years	105.5	83.9	157.9*
25-29 Years	115.7	93.1	151.4
30-34 Years	153.3	111.2	284.5
35 Years and Over	199.3	155.0	257.6
	NUMBER OF PREGNANCIES ³		
20-24 Years	739	632	95
25-29 Years	1,755	1,440	251
30-34 Years	1,605	1,286	239
35 Years and Over	1,079	826	198

¹ Excluded, because of small numbers, are 34 pregnancies of multigravidae under 20 years of age.

² Totals include pregnancies with outcome of last prior pregnancy not stated.

³ Excludes pregnancies with age of mother unknown.

* Rate based on only 15 fetal deaths.

¹⁴ Defined as the time between the end of one pregnancy and the LMP prior to the next pregnancy.

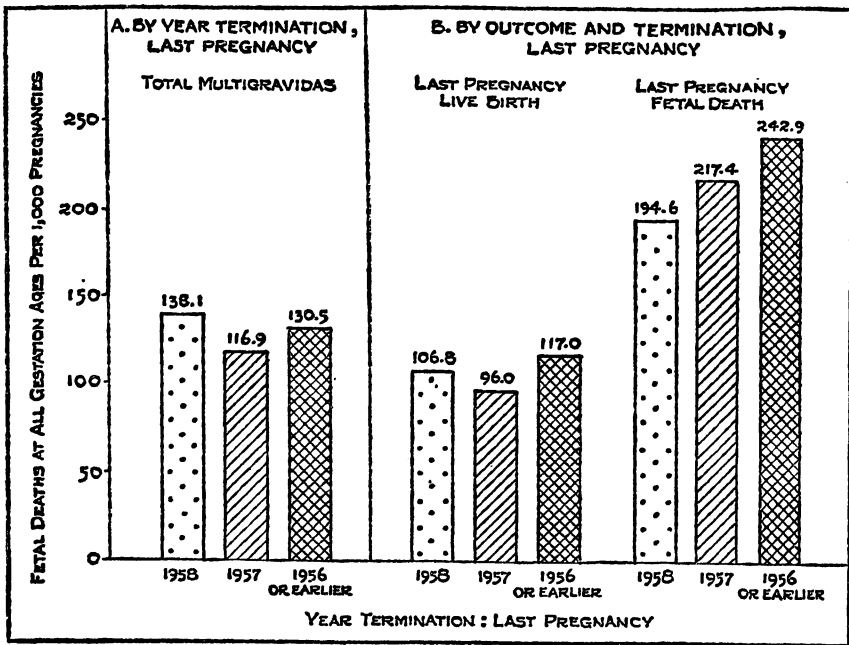


Fig. 5. Total fetal loss by outcome of last prior pregnancy and calendar year of termination of last pregnancy: multigravidae only (pregnancies with LMPs March 1, 1958–February 28, 1959).

Table 7. Fetal loss by outcome of last prior pregnancy and calendar year of termination of last pregnancy, for multigravidae only.

YEAR OF TERMINATION: LAST PRIOR PREGNANCY	OUTCOME OF LAST PRIOR PREGNANCY		
	Total ¹	Live Birth	Fetal Death
	FETAL DEATHS PER 1,000 PREGNANCIES		
1958	138.1	106.8	194.6
1957	116.9	96.0	217.4
1956 or Earlier	130.5	117.0	242.9
	NUMBER OF PREGNANCIES ²		
1958	934	599	334
1957	1,386	1,146	230
1956 or Earlier	2,629	2,402	210

¹ Totals include pregnancies with outcome of last prior pregnancy not stated.

² Excludes pregnancies with year of termination of last pregnancy not stated.

whose last pregnancies ended in 1957 is slightly lower than the corresponding rate for the women in the 1958 group. The rate then increases again slightly for the 1956 or earlier group. Although these changes are subject to the qualification of small numbers of cases, they reflect the type of association between interval and fetal loss found in other studies. That is, the risk is higher in short and long intervals than in moderate intervals.

The relationship cannot, however, be accepted at face value. A critical point to be considered is that important differences in prior reproductive experience exist among the three groups of women. Thirty-six per cent of the last previous pregnancies in the 1958 group ended in a fetal death as compared with 17 per cent in the 1957 group and less than 10 per cent in the 1956 or earlier group. The significance of this fact is seen in Fig. 5B and Table 7 which show fetal loss rates in the current pregnancies for women classified by the outcome of the last previous pregnancy. These rates do not give the impression of a consistently higher risk being associated with the 1958 group and this leads to speculation about the meaning of other observations that indicate a special risk among women who have a short interval between pregnancies. Greater numbers of cases are needed than were available here to pursue this matter further. Also, a more exact measure of interval would help. Both will become available when all phases of the study under way are completed.

Before leaving the data on year of last pregnancy, it is worth noting that prior pregnancy outcome is a dominant factor regardless of when the previous pregnancy ended. For each of the years given, women whose last pregnancy ended in a fetal death had twice as high a loss in the current pregnancy as other women.

SUMMARY AND DISCUSSION

The probability of a pregnancy terminating in specified weeks of gestation, and the association between various characteristics of the mother and fetal loss are examined in the

current paper. The findings represent initial results of a study under way in HIP which has as its ultimate objective the investigation of the relationship of maternal morbidity and other conditions in the mother to pregnancy outcome, congenital anomalies and other disorders in the offspring. Medical records in HIP are the primary source of information. These records provide data for all pregnancy terminations known to the physician. Accordingly, it is believed that this source identifies virtually all fetal deaths except for illegal abortions and cases in which the pregnancies were unknown to the women themselves.

In summary, the major findings are:

1. The probability of a pregnancy ending in a particular week of gestation as determined from physicians' records follows a bimodal distribution. The initial peak occurs during the pre-viability period, more specifically at 10 weeks gestation, as measured from the LMP. The second and much higher peak occurs at 40 weeks, which is generally regarded as approximating the desired, full-term period of gestation.

2. The rate of total fetal loss is 142 per 1,000 pregnancies. About half of the loss (48 per cent) is under 12 weeks gestation, another 32 per cent is at 12-19 weeks, and 12 per cent is at 20 weeks or more gestation. (The rest of the cases are of unknown gestation age).

3. Fetal loss increases with age of mother after age 20. This relationship is found at all durations of pregnancy. Total fetal loss also varies directly with gravida of the mother. Here, however, there is a difference in the pattern between the terminations at 20 weeks or more gestation, and those that terminate earlier. In the former group gravida 1 women have a higher rate of fetal loss than gravida 2 women. At the early gestation ages, (12 weeks or less) the situation is reversed with gravida 1 women having the lower rate.

4. Outcome of the last prior pregnancy is a major factor in the outcome of the current pregnancy. Women whose last

pregnancy ended in a fetal death have twice as high a loss rate in their next pregnancy as other women. The increased risk is present at every stage of the gestation cycle and is independent of age of mother, gravidity, and year of last prior pregnancy.

To a considerable extent the relationships described for the 20 weeks or more gestation group confirm findings in other studies. This observation is of some consequence because the data in the current series do not suffer from the often met problem of serious under-registration of fetal deaths, and because it is further evidence of a consistency in these relationships for different types of populations.

Of perhaps even greater interest is the finding that the associations between fetal loss and characteristics of the mother generally persist throughout the gestational cycle. The only exception is an inconsistency in the relative magnitude of fetal death rates for gravida 1 and 2 women. The higher rate for gravida 1 women at 20 weeks or more gestation may well reflect special hazards in this group associated with the birth process of a viable fetus.

The consistency in the relationships at all stages of pregnancy, with the exception mentioned, raises the possibility that in fetal loss biological and environmental factors retain their same comparative importance, early as well as late in pregnancy. A counter hypothesis that might be advanced is that adverse biological and environmental circumstances are correlated. Under this hypothesis, consistencies of the type found could occur even though there is a change in the relative importance of these two sets of conditions.

The observation that the outcome of the current pregnancy is strongly associated with the outcome of the last prior pregnancy merits special attention. Similar observations have been made by other investigators and information on prior reproductive loss is viewed by the obstetrician as important for the management of the patient. But the doubling in risk among women whose last pregnancy ended in a fetal death, regardless of other characteristics, indicates that we are dealing with a

basic phenomenon which should be a focal point of future studies. One of the objectives of the current investigation is to explore this issue further.

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APPENDIX

SOURCE OF DATA, METHODOLOGY AND DEFINITION OF TERMS

SOURCES OF DATA

The basic sources of data for the current paper were two medical records used in the regular operation of the Health Insurance Plan of Greater New York. These are the "Med 10" and the "Pregnancy Record." The "Med 10" is used by HIP physicians to report medical services to members of the Plan. Every time a member is seen by a physician, an entry is made on the record form, giving the patient's name, the type of service rendered, and the diagnosis of the medical condition. The patient is further identified by sex and year of birth, and HIP certificate number, and the entry is dated and identified as to medical group. Med 10s are sent monthly to HIP's Division of Research and Statistics. The "Pregnancy Record" is filled out by the obstetrician and is a part of the patient's medical chart. The record form is started on the occasion of a pregnant patient's first visit to her obstetrician during a pregnancy and is continued throughout the pregnancy and the post-partum period. The

form provides space for recording family history and medical history, prior obstetrical history, results of prenatal examinations, delivery notes and post-partum examination findings.

The Med 10s and Pregnancy Records from HIP's 29 medical groups in New York City were used for this study. Records from the two Nassau County groups and the one in Columbia County were excluded because of special procedural problems involved in collecting the data. These groups will be included in the more detailed analyses which will be forthcoming.

In addition to the medical records described, the certificates of live birth and fetal death on file in the New York City Department of Health were used to obtain information on outcome of pregnancy and on prior pregnancy history for those few pregnancies for which the medical records were incomplete.

COLLECTION OF DATA

The first step in the collection of data was the establishment of a tentative "Pregnancy Register." Pregnancies to be included in this segment of the study were, by definition, those for which the LMP began in the period March 1, 1958, through February 28, 1959. In order to include all such pregnancies known to HIP obstetricians, especially the very early fetal deaths, the Med 10s of HIP obstetrician-gynecologists starting with the month of April, 1958 were reviewed for entries with diagnoses indicating the possibility of a *terminated pregnancy*. To avoid failure in locating fetal deaths, the following list of terms was used to screen for "terminated pregnancies."

- Delivery (with any qualifying terms) and all synonyms
- Cesarean Section
- Placenta Praevia
- Fetal Death or Stillbirth (with any qualifying terms)
- Abortion or Miscarriage (with any qualifying terms)
- Ectopic Pregnancy or Gestation (and synonyms, including operative procedures)
- Hydatidiform Mole
- D & C (unless accompanied by a diagnosis of a non-obstetric condition)
- Other indications of surgery which may refer to the removal of

products of conception (e.g. salpingectomy, removal of placenta).

The obstetrical chart for each woman on the tentative "Pregnancy Register" was then reviewed in the medical group center to obtain data needed to determine whether the condition had in fact been a pregnancy and, if so, whether the LMP was February 1, 1958 or later. If the case fell in the study, a wide range of additional information required for the full investigation was abstracted. Personnel hired for abstracting medical data were given intensive instruction and orientation, and then were supervised by the professional members of the Pregnancy Study staff.

The last phase of data collection was the vital records check. All reported fetal deaths were checked against the New York City Department of Health file of fetal death certificates, as were all pregnancies for which the outcome was not known or was in doubt. Those for whom fetal death certificates were not located were then checked against the file of live birth certificates. The classification by certification was considered authoritative; for example, three pregnancies were first classified (from information on the obstetrical chart) as resulting in fetal death but were reclassified as resulting in live birth after the location of live birth certificates. For the very small number of live births for which LMP or mother's prior pregnancy history was not known, the live birth certificates were located and the data abstracted, if available.

Although a complete search for certificates for all live births in the study was not accomplished at this time, the procedure will be carried out before the completion of the final report. The possibility that a birth reported as "alive" on the obstetrical records should be certified as a fetal death by the attending physician is so slight that it may be ruled out for all practical purposes at this time.

DEFINITION OF TERMS

For identification of cases in this report and for their classification, definitions had to be established for the kinds of cases included in the study, the basis for classification of diagnoses, the date from which to calculate the beginning of pregnancy, the date of termination of pregnancy (and consequently, the gestation age at termination and the outcome of pregnancy). The working definitions were as follows:

(1) *Pregnancies included in this study* were those reported on

Med 10s and confirmed by chart review as ending in a delivery or operative procedure by *HIP physicians*. Also included were those pregnancies resulting in fetal death without operative procedure but the diagnoses of which were made as a part of medical services by *HIP physicians*. If the chart indicated that the termination had been attended by a physician outside of *HIP*, the case was excluded since there was no way to establish the characteristics of all pregnancies under care outside of *HIP*.

The first year's cohort of pregnancies (with which this report is concerned) is defined as those pregnancies in which the first day of the LMP occurred on or between the dates March 1, 1958, and February 28, 1959. When the LMP could not be obtained from medical records or from vital records, the following assumptions were made:

(a) pregnancies resulting in fetal death other than ectopic gestations or hydatid moles with dates of termination in April or May, 1958, or with dates of termination in June, 1959 or later, were assumed to have LMPs outside the dates specified above.

(b) ectopic pregnancies and pregnancies resulting in hydatid moles with dates of termination in April, 1958 or with dates of termination in May, 1959 or later were assumed to have LMPs outside the dates specified above.

(2) *A diagnosis of pregnancy* was considered established if a demonstrable fetus was recovered; if the microscopic examination of uterine contents revealed fetal, placental or decidual tissue; if the result of the Aschheim-Zondek test (or other urine test for diagnosis of pregnancy) was positive; if there was a positive and definitive clinical diagnosis of fetal death, with or without positive laboratory findings; or if, in the absence of all the above conditions, there was nevertheless a fetal death certificate on file in the NYC Department of Health.

The numbers of fetal deaths included in the study on the basis of the above criteria are discussed in a later section of this Appendix, as are the cases which were *not* included in the study because of failure to meet the standards described.

(3) *The beginning of the pregnancy* was considered to be the first day of the woman's last menstrual period (LMP), as indicated in the medical chart or certificate on file (discussed above). (This provided a consistent basis for calculation of period of gestation).

(4) *The termination of pregnancy* was defined as follows:

The "date of termination" was the date of birth of a live born child or, in the case of fetal death, the date of expulsion of the fetus, if the fetus had been recovered and/or identified by the attendant or reporting authority, whether or not the placenta was expelled. This is in accord with the definition of terms relating to fetal death in the Sanitary Code of the City of New York (Article 3, Section 32).

In the absence of such positive evidence of a terminated pregnancy, the "date of termination" was the date of operative procedure for the removal of products of conception. If there was no operative procedure, the physician's statement of date of termination of pregnancy was considered definitive. In the absence of a definitive statement of date of termination by the physician, the "date of termination" was taken to be the *date of final diagnosis* of terminated pregnancy.

(5) *The gestation age* of the pregnancy was calculated to be the time in completed weeks from the first day of the LMP to the date of termination of pregnancy as defined above. These working definitions made it possible to calculate gestation age on a consistent basis for all the pregnancies in the study. It will be realized, however, that the period of gestation calculated in this way is longer than the time between the LMP and the date of fetal death, particularly in cases diagnosed "missed abortions." The effects of calculating gestation age differently are discussed later.

(6) *The outcome of pregnancy* was either live birth or fetal death as defined in Article 3, Sections 31 and 32, of the Sanitary Code of the City of New York (as amended to December 21, 1956).

EXCLUSIONS

From the original tentative pregnancy register, three kinds of cases were excluded from this report on the basis of diagnostic data: (1) those which had been included because of a Med 10 entry which did not specify an obstetric condition but which might possibly refer to a pregnancy terminating in fetal death, and which were found (on review of medical records) never to have referred to a pregnancy at all; (2) those which were diagnosed as possible pregnancies but which were found to have final diagnoses ruling out the existence of a pregnancy; and (3) those for which the final diagnosis was still that of a questionable or doubtful pregnancy. The first of these

kinds of cases represented about 5 to 6 per cent of all the Med 10 entries which were checked against the medical charts. For the most part, they were found to refer to diagnostic D & C's for a variety of gynecologic symptoms or D & C's for removal of cervical polyps. These cases were removed from the tentative register, as described in the paragraphs on collection of data. The exclusion from this report of the second and third kinds of cases depended upon a classification of diagnostic data and are described in detail below.

Cases with Final Diagnosis of Non-Obstetric Condition: Cases with a preliminary diagnosis of possible pregnancy but which were excluded because of a subsequent diagnosis of a non-obstetric condition numbered only 51. Of these, 27 were first thought to be symptomatic of a fetal death or a threatened abortion, but had final diagnoses which ruled out pregnancy; and 24 were referred for continued observation to rule out a possible ectopic gestation. Where there was no definitive final diagnosis recorded by the obstetrician, the wording of the pathology laboratory report was used for classification purposes. In the absence of definite indications of pregnancy in the pathology report (chorionic villi, placental or decidual tissue, etc.), descriptions of the endometrium such as secretory, hyperplastic, proliferative, etc., were considered to refer to normal phases of the menstrual cycle.

The eight cases for which the medical notes are quoted below are representative of this group, all of which were removed from the pregnancy register.

(1) 11-13-57: "Exploratory laparotomy for ectopic."

11-19-58: "Emergency—anomalous bleeding and severe abdominal pains. Taken to ——— Hospital where findings were strongly suggestive of ectopic pregnancy. Culdoscopy performed and revealed right tubal gestation. However, at laparotomy tubes were normal. Varicosity in right infundibulo-pelvic ligament was apparently mistaken for an ectopic by culdoscopist."

(2) 7- 1-58: "IMP 4-26-58; vaginal bleeding 6-13-58. Pain in RLQ for 3 weeks. Dx: R.O. old rt. ectopic."

7-23-58: "LMP 7-16-58. AZ negative. Exam.: mass not palpable. Pelvis normal."

- (3) 2-24-59: "Two weeks after February period stained for one day. Small mass in left fornix—uterus normal. Rt. adnexa not palpated. Ectopic to be considered; not sufficient symptomatology to be hospitalized."
 3-17-59: "Recheck: no pathology."
- (4) 9- 3-58: (Phone) "Staining 2 days. Rx stop norlutin. Rx methyl test 25 mg × 10 starting tomorrow."
 9-10-58: "Severe lower abdominal pains past 2 days. Bleeding has not stopped since last menstrual period August 22nd. In cul-de-sac tender mass difficult to delineate exactly but exquisitely tender to rotation. Cx post. closed. Dark bleeding. Imp.: R.O. ectopic pregnancy."
 9-11-58: In hospital. "Observation for ectopic pregnancy." Microscopic: "Endometrium in proliferative phase."
- (5) 12-17-58: (First "prenatal" visit. LMP 9-24-58. Findings normal).
 12-29-58: "Imp.: Missed abortion."
 1-14-59: "Breasts have begun to feel heavy again. Uterus today about 8 weeks size. Most likely explanation is a pregnancy started in October with a missed abortion then reimpregnation before next menses after 1st ovulation."
 1-28-59: "Bled 3 days (1/20-1/22). Imp.: Not pregnant."
 2-18-59: Hysteroqram: Bilateral tubal block. "Patient couldn't have been pregnant."
- (6) 1- 8-59: "Patient has been bleeding since 1-5-59. Imp.: Fibroid uterus. Completed Ab? Incomplete Ab?"
 1-29-59: Hospitalized. Pathology report: "cervical polyp with acute inflammation."
- (7) 2- 5-59: "Missed abortion?" Rx D & C.
 2- 5-59: "Diagnostic D & C." Microscopic: "Uterine curettings, hyperplastic proliferative phase endometrium."
- (8) 7-30-58: "Pre-operative visit at hospital."
 7-31-58: "D & C done for incomplete abortion (?). Uterus 6-7 weeks size. Pre-operative diagn.: Fibroid uterus, incomplete abortion. Pathology report: (1) noncancerous endometrium in follicular phase. (2) Benign cervical polyp."

Cases With Final Diagnosis Doubtful: In 73 instances, possible pregnancies were excluded from this report because the final diagnosis of pregnancy was in doubt. It should be noted that these cases were not removed from the pregnancy register, and the procedure of collecting data about them was the same as for cases with definite diagnoses. For these cases, however, there was no known laboratory work which would confirm a diagnosis of pregnancy, the clinical diagnosis by the attending obstetrician either was an expression of inconclusion evidence of pregnancy or was of a threatened abortion with no subsequent information about the outcome, and there was no fetal death certificate (or live birth certificate) on file in the city health department. Seven of the patients were hospitalized at or about the time of report, and the remaining 66 pregnancies, if they were pregnancies, terminated without hospitalization. These cases are classified by Med 10 entry as follows:

	<i>Hospitalized</i>	<i>Not Hospitalized</i>
<i>Total questionable pregnancies</i>	7	66
Threatened abortion, no information on outcome	2	5
Possible abortion (complete or incomplete)	5	56
Possible missed abortion	—	5

About two-thirds of these patients were seen only once by their obstetricians in HIP and another 25 per cent were seen only twice. Nearly all of these patients presented a history of an episode which was probably completed at the time of first visit to the obstetrician. The examples of clinicians' statements below are typical of this group.

- (1) 4-21-59: "Period 2-6-59. Stained with flow 1 day 3-21-59. On 4-17-59, stained. Rx nugesterol. (Regular flow 2 days). No clots. Pelvis now negative."
Dx.: ?Pregnancy ?Abortion
- (2) 7-22-58: "LNMP 6-7-58. Due July 4th, but no bleeding until 7-9-58. Bleeding on and off since. On 7-15-58 passed sac-like material. On 7-17-58 and 7-20-58,

fleshy material. Started staining after this—has breast discharge.”

IMP.: Complete abortion?

- (3) 6-6-58: “Patient states that about 5 days ago she had an episode of moderately heavy bleeding following 2 months of amenorrhea, during which time she thought she was pregnant. The bleeding has practically stopped at the present time. Exam.: cx posterior, clean. Uterus anterior, normal. Adnexae. neg.” Dx. ?Pregnancy aborted.
- (4) 10-31-58: “Last normal period 9-8-58. Ten days after skipped October period, AZ negative. On 10-24-58 bled fairly heavily with cramps and on 28th passed a clot. Since then has continued to bleed. Exam.: cx closed, uterus plump. It is impossible to say whether patient has an incomplete abortion or that she is bleeding from functional dyscrasia. The possibility is that it was an incomplete.”
- (5) 6-9-59: “LMP 2½ months ago × 5. Two weeks later had flow for 1 day. Several days later spotting returned for several days. Time of next period had bleeding about 2 days with intermittent bleeding since. Today had clot passed (about 2 × 5 cm.) with flow again. Pain in left lower abdomen.
Dx.: Left eptopic? Rx hospital.

Appendix Table I. Comparison of gestation age of fetal deaths included in the study and pregnancies excluded because of questionable diagnoses.

GESTATION AGE	FETAL DEATHS IN STUDY		QUESTIONABLE FETAL DEATHS		RATIO QUEST. FETAL DEATHS TO FETAL DEATHS IN STUDY
	Number	Per Cent	Number	Per Cent	
TOTAL	970	100.0	73	100.0	1:13
Under 12 Weeks	465	47.9	47	64.4	1:10
Under 8 Weeks	100	10.3	17	23.3	1:6
8-11 Weeks	365	37.6	30	41.1	1:12
12-19 Weeks	312	32.2	8	11.0	1:39
20 Weeks or More	118	12.2	3	4.1	1:39
Unknown	75	7.7	15	20.5	1:5

The estimated gestation age of pregnancies excluded as questionable is shown in Appendix Table I. The interval between LMP and possible pregnancy termination was less than 12 weeks for nearly two-thirds of these cases. For one-fifth the LMP was not reported. Probably many of these were of short duration.

Gravidity and outcome of last prior pregnancy of women whose diagnoses were classified as questionable were as follows:

	<i>Number of Cases With Questionable Diagnoses</i>
Total Questionable Fetal Deaths	73
<i>Gravidity:</i>	
1	7
2 and 3	27
4 or more	28
Unknown	11
<i>Outcome of Last Prior Pregnancy</i>	
No prior pregnancy	7
Live birth	29
Fetal death	12
Unknown	25

Although data on gravidity and prior pregnancy outcome were lacking for many of these cases, the proportion in the category "gravidity 4 or more" (38 per cent) was greater than the proportion of fetal deaths in the study in that category (28 per cent). The proportion of questionable cases with prior pregnancy resulting in fetal death (16 per cent) was also slightly larger than the comparable figure for fetal deaths in the study (12 per cent). Inclusion in the study of these questionable cases, therefore, would have increased the observed differences in fetal death rates between women of higher and lower orders of gravidity and also the differences according to prior pregnancy outcome.

Had the 73 cases with questionable diagnoses been included in the study, the number of fetal deaths shown therein would have been 1,043, the number of total pregnancies 6,917, and the fetal death rate would have been 15.1 per cent as contrasted with 14.2 per cent based on cases with more definite diagnoses.

OTHER EXCLUSIONS

Therapeutic and self-induced abortions were also excluded from this report since these cases are not pertinent to an analysis of risk of fetal loss according to gestation age. (There were only two cases so identified.) Whether or not some of the fetal deaths included represented cases presenting themselves to obstetricians after attempts at self-induction is a matter of speculation; there are no data on the subject available here.

Other Exclusions—Plural Births: The unit of analysis in the current study is the pregnancy, each pregnancy being classified as terminating in a "live birth" or "fetal death." The classification of

Appendix Table II. Outcome of pregnancies resulting in multiple births by gestation age.

GESTATION AGE IN WEEKS	NUMBER OF PREGNANCIES RESULTING IN MULTIPLE BIRTHS								NUMBER OF BIRTHS IN PREGNANCIES RESULTING IN MULTIPLE BIRTHS		
	Classification of ¹ Outcome of Pregnancy			Outcome of Pregnancy in Detail							
	Total	Live Birth	Fetal Death	Twins:			Triplets:		Total	Live Birth	Fetal Death
				Both Born Alive	One Alive, One Dead	Both Fetal Deaths	All Three Born Alive	Two Alive, One Dead			
TOTAL	70	67	3	62	3	3	1	1	142	132	10
10	1	—	1	—	—	1	—	—	2	—	2
14	1	—	1	—	—	1	—	—	2	—	2
16	1	—	1	—	—	1	—	—	2	—	2
25	1	1	—	1	—	—	—	—	2	2	—
26	1	1	—	1	—	—	—	—	2	2	—
27	1	1	—	1	—	—	—	—	2	2	—
29	1	1	—	—	—	—	—	1	3	2	1
31	2	2	—	2	—	—	—	—	4	4	—
32	2	2	—	2	—	—	—	—	4	4	—
33	1	1	—	1	—	—	—	—	2	2	—
34	1	1	—	1	—	—	—	—	2	2	—
35	1	1	—	1	—	—	—	—	2	2	—
36	5	5	—	5	—	—	—	—	10	10	—
37	8	8	—	8	—	—	—	—	16	16	—
38	21	21	—	20	1	—	—	—	42	41	1
39	9	9	—	8	—	—	1	—	19	19	—
40	8	8	—	7	1	—	—	—	16	15	1
41	3	3	—	3	—	—	—	—	6	6	—
43	1	1	—	1	—	—	—	—	2	2	—
Not Stated	1	1	—	—	1	—	—	—	2	1	1

¹ A pregnancy was assigned to the category "live birth" if one or more of the children in the plural set were born alive. All others were classified as "fetal death" pregnancies.

outcome when the product of conception was a single birth or a single outcome was obvious. However, when a multiple birth involved both a live birth and a fetal death, the decision was made to classify the pregnancy according to the more "favorable" outcome, i.e., as resulting in a live birth. The number of pregnancies given in the tables accompanying this report can be converted to numbers of births by using the detailed data on multiple births in the Appendix Tables II & III. It should be understood, however, that for fetal deaths of very early gestation age, it is rarely known whether the pregnancy involved a single or a multiple gestation.

Appendix Table III. Age of mother, gravidity, and prior pregnancy outcome for pregnancies resulting in multiple births.

AGE OF MOTHER, GRAVIDITY, AND OUTCOME OF LAST PRIOR PREGNANCY	NUMBER OF PREGNANCIES RESULTING IN MULTIPLE BIRTHS			NUMBER OF BIRTHS IN PREGNANCIES RESULTING IN MULTIPLE BIRTHS		
	Total	Classification of Outcome ¹		Total	Live Births	Fetal Deaths
		Live Birth	Fetal Death			
TOTAL	70	67	3	142	132	10
<i>Age of Mother at LMP:</i>						
Under 20	1	1	—	2	2	—
20-24	13	13	—	27	25	2
25-29	31	30	1	63	59	4
30-34	16	14	2	32	28	4
35 and Over	9	9	—	18	18	—
<i>Gravidity:</i>						
1	11	11	—	23	20	3
2	22	21	1	44	41	3
3	17	17	—	35	35	—
4 or More	20	18	2	40	36	4
<i>Outcome and Calendar Year of Last Prior Pregnancy (Multigravidae Only):</i>						
1958: Live Birth	8	7	1	16	14	2
Fetal Death	2	2	—	4	4	—
1957: Live Birth	12	12	—	25	25	—
Fetal Death	2	2	—	4	4	—
1956 or Earlier: Live Birth	26	25	1	52	49	3
Fetal Death	7	7	—	14	14	—
Year Unknown: Live Birth	—	—	—	—	—	—
Fetal Death	1	1	—	2	2	—
Outcome Un- known	1	—	1	2	—	2

¹ A pregnancy was assigned to the category "live birth" if 1 or more of the children in the plural set were born alive. All others were classified as "fetal death" pregnancies.

Appendix Table IV. Distribution of fetal deaths by gestation age at termination: fetal deaths classified by basis for diagnosis of pregnancy and outcome.

GESTATION AGE AT TERMINATION	ALL FETAL DEATHS		FETAL DEATHS EXCLUSIVE OF ECTOPIC PREGNANCIES AND HYDATID MOLES					ECTOPIC PREGNANCIES AND HYDATIDIFORM MOLES
			Total	Basis for Diagnosis of Pregnancy and/or Fetal Death*				
	Micro. Diagnosis of Fetal, Placental and/or Decidual Tissue	Definitive Clinical Diagnosis Only		Other				
		Patient in Hospital			Patient Not in Hospital			
Number	Per Cent							
TOTAL	970	100.00	933	511	223	147	52	37
2	2	0.21	2	—	2	—	—	—
3	6	0.62	4	1	1	2	—	2
4	8	0.82	4	—	1	3	—	4
5	14	1.44	11	7	1	3	—	3
6	29	2.99	27	11	4	8	4	2
7	41	4.23	38	23	4	9	2	3
8	51	5.26	46	25	6	14	1	5
9	97	10.00	94	41	25	22	6	3
10	115	11.86	114	59	33	14	8	1
11	102	10.52	101	59	26	13	3	1
12	85	8.76	83	49	24	8	2	2
13	68	7.01	66	29	24	9	4	2
14	50	5.15	49	23	14	6	6	1
15	31	3.20	31	17	9	4	1	—
16	23	2.37	23	13	5	3	2	—
17	25	2.58	25	15	4	4	2	—
18	18	1.86	18	12	4	1	1	—
19	12	1.24	12	9	1	1	1	—
20	10	1.03	10	5	2	2	1	—
21	15	1.55	14	12	2	—	—	1
22	6	0.62	6	6	—	—	—	—
23	5	0.52	5	2	2	1	—	—
24	5	0.52	4	2	1	—	1	1
25	8	0.82	8	6	1	1	—	—
26	7	0.72	7	5	2	—	—	—
27	—	—	—	—	—	—	—	—
28	5	0.52	5	2	2	—	1	—
29	1	0.10	1	1	—	—	—	—
30	4	0.41	4	4	—	—	—	—
31	3	0.31	3	1	—	1	1	—
32	1	0.10	1	1	—	—	—	—
33	2	0.21	2	2	—	—	—	—
34	5	0.52	5	5	—	—	—	—
35	6	0.62	6	6	—	—	—	—
36	6	0.62	6	5	1	—	—	—
37	4	0.41	4	4	—	—	—	—
38	5	0.52	5	5	—	—	—	—
39	5	0.52	5	5	—	—	—	—
40	6	0.62	6	5	—	1	—	—
41	6	0.62	6	6	—	—	—	—
42	2	0.21	2	1	1	—	—	—
46	1	0.10	1	1	—	—	—	—
Unknown	75	7.73	69	26	21	17	5	6

* Bases for diagnosis of pregnancy and/or fetal death:

1. Pathology Laboratory confirmation of diagnosis of fetal death through microscopic examination of curettings or other uterine contents, with report of fetal, placental and/or decidual tissue. This group also includes those pregnancies not terminating with curettage but for which the fetus was identified by the attending physician.

2. Pregnancies classified as fetal deaths on the basis of definitive clinical diagnoses alone. These are subdivided in two groups: one in which the patient was hospitalized, and one in which the patient was not. Hospitalized patients nearly all had pregnancies terminating with D & C and the laboratory confirmation of diagnosis no doubt was obtained by the hospital but was not included in the patient's chart in HIP Medical Group. These cases are thought to be comparable with those for whom laboratory confirmation was reported. Those patients not in hospitals are those for whom a diagnosis of pregnancy was made on the basis of clinical findings and/or patients' history, and for whom no laboratory work was reported.

3. Other bases for classification were:

a. Report of positive AZ test, with or without definitive clinical diagnosis, but without confirmation by Pathology Laboratory.

b. Location of a fetal death certificate in New York City Health Department with none of above bases for classification.

Of the total 6,844 pregnancies in the study, 70 resulted in multiple births; 68 were twin births and 2 were triplets. Only 3 deliveries of plural births were reported under 20 weeks gestation; in each of these, twin fetuses were reported by the hospital pathology laboratories.¹ The distribution of multiple-birth pregnancies by gestation age at delivery presents a curve similar in shape to that for single-birth pregnancies except that the peak incidence of multiple births was at 38 weeks in contrast to the peak at 40 weeks for single birth.

CLASSIFICATION OF PREGNANCIES ACCORDING
TO BASIS FOR DIAGNOSIS

In the current study, the diagnosis of "pregnancy" had to meet one of the following criteria:

- (1) delivery with a baby or a demonstrable fetus as the outcome;
- (2) microscopic diagnosis of fetal, placental and/or decidual tissue;
- (3) positive AZ test;
- (4) definite clinical diagnosis only (in the absence of the above criteria);
- (5) certificate on file in NYC Department of Health.

Gestation age distributions of the 970 fetal deaths by criterion met are given in Appendix Table IV. In this table, pregnancies for which a demonstrable fetus was identified by the attending physician are included with those with diagnosis confirmed through microscopic examination of curettings or other uterine contents and report of fetal, placental and/or decidual tissue. It is recognized that the report of decidual tissue alone may not be sufficient evidence of pregnancy for unequivocal diagnosis, but these patients presented clinical evidence also which led to a diagnosis by the obstetrician of pregnancy and fetal death before the surgical procedure.

The pregnancies categorized as fetal deaths on the basis of defini-

¹ Patient E. K.: D&C for incomplete abortion at 10 weeks after LMP. Hospital pathology laboratory microscopic examination of curettings: "2 fetuses, 2 placentas."

Patient L. C.: D&C for septic abortion at 14 weeks after LMP. Hospital pathology laboratory report: "Specimen consists of 2 male fetuses, each measuring 10.5 cm. in length; one is macerated."

Patient D. K.: D&C incomplete abortion at 16 weeks after LMP, followed on next day by exploratory laparotomy with appendectomy for perforated appendicitis. Hospital pathology laboratory examination of curettings: "2 male fetuses, each measures 12½ cm. crown-rump; 2 amnions, one chorion, one placenta. Each fetus weighs 180 gms. There are no developmental anomalies."

tive clinical diagnosis without laboratory confirmation in the chart were divided into two groups, one in which the patient was hospitalized and one in which the patient was not. Hospitalized patients nearly all had pregnancies terminating with D & C and the laboratory confirmation of diagnosis no doubt was obtained by the hospital.² These cases are probably comparable, therefore, with those for which laboratory confirmation was reported. The patients not in hospitals were those for whom a diagnosis of pregnancy was made on the basis of clinical findings and/or patient's history, and for whom no laboratory work was reported.

Ectopic gestations and hydatidiform moles are shown separately, as representing a different kind of risk of pregnancy termination. These were all terminated by surgery with laboratory confirmation of diagnosis.

The numbers of pregnancies resulting in fetal death in each of the diagnostic categories were:

<i>Basis for Diagnosis of Pregnancy</i>	<i>Pregnancies Resulting in Fetal Death:</i>	
	<i>Number</i>	<i>Per Cent</i>
Total	970	100.0
Ectopic gestation and hydatidiform moles	37	3.8
Total other than ectopics and hydatidiform moles	933	96.2
Microscopic diagnosis of fetal, placental and/or decidual tissue*	511	52.7
Positive AZ test (without microscopic confirmation of diagnosis)	45	4.6
Definitive clinical diagnosis only: patient in hospital	223	23.0
Definitive clinical diagnosis only: patient not in hospital	147	15.2
Fetal death certificate only (in absence of all of above criteria)	7	0.7

* Includes demonstrable fetus.

² Hospital records will subsequently be obtained to classify cases by type of evidence in the records.

Analysis of gestation age of terminated pregnancies in the various diagnostic categories (exclusive of ectopics and hydatidiform moles) shows that the distribution of terminations by week of gestation gives curves of a similar shape for all groups of cases. The fact that the peak incidence of terminations is one week earlier for patients with clinical diagnoses only who were not hospitalized, is related to the definition of termination of pregnancy. Had these patients been hospitalized for surgery as a result of the clinical diagnosis, the time between clinical diagnosis and operative procedure might well have averaged one week.

RE-CALCULATION OF GESTATION AGE

Gestation age of pregnancies was calculated from the LMP and the date of termination of pregnancy as specified in the definitions. It was pointed out that the date of termination of pregnancy is not the same as the date of fetal death. The effect of a different termination date on the calculations in this report has been examined.

The gestation age of 970 fetal deaths was re-calculated as the time in complete weeks between the first day of the LMP and the date of *earliest diagnosis of probable fetal death*. When the final diagnosis was fetal death (as for all cases included in this report), the final diagnosis was thought to verify any tentative diagnosis made at an earlier date. Thus the earliest date of diagnosis by the obstetrician of possible fetal death, for example "inevitable abortion," "possible" or "probable incomplete abortion," was considered to be the earliest diagnosis of fetal death. Other decisions were made as follows:

The doctor's retrospective diagnosis of probable date of fetal death was also considered to be the earliest date of diagnosis of fetal death.

The recommendation or referral for D & C by the obstetrician was considered a diagnosis of fetal death for purposes of this coding procedure, except that recommendation of a *diagnostic* D & C was not considered to be diagnostic of fetal death.

If there was no date of diagnosis prior to date of termination as originally coded, and a fetus was recovered, the reported estimate of age of fetus was used for coding probable date of fetal death. However, statements of size of uterus in terms of weeks of gestation were *not* used for probable age at fetal death.

In two cases involving fetal deaths after 20 weeks of gestation, the dates at which absence of fetal heart tones were first recorded were considered dates of probable fetal death.

BASIS FOR DIAGNOSIS OF PREGNANCY AND/OR FETAL DEATH	ALL FETAL DEATHS	PREGNANCIES TERMINATING IN FETAL DEATH FOR WHICH A PRIOR DATE OF "PROBABLE FETAL DEATH" WAS REPORTED			
		Total with Prior Date	No Change in Week of Gestation Age	Week of Gestation Age Changed	
				Number	Per Cent of all Fetal Deaths
ALL FETAL DEATHS	970	145	59	86	8.9
Fetal Deaths, excluding Ectopic Pregnancy and Hydatidiform Mole, Total	933	132	54	78	8.4
Microscopic Diagnosis of Fetal, Placental and/or Decidual Tissue	511	71	28	43	8.4
Definitive Clinical Diagnosis Only	370	45	19	26	7.0
Other	52	16	7	9	17.3
Ectopic Pregnancy and Hydatidiform Mole	37	13	5	8	21.6

Appendix Table V. Fetal deaths for which gestation age could be calculated from more than one termination date: fetal deaths classified by basis for diagnosis of pregnancy and outcome.

Of the 970 records of pregnancies terminating in fetal death, only 145 or 15 per cent carried information which could be used as a date of probable fetal death prior to the date of termination already coded. In 59 of these, the use of prior date made no change in completed weeks of gestation of the pregnancy, so that the week of gestation was changed in only 86 or 8.9 per cent. The percentages are shown in Appendix Table V for pregnancies classified broadly as to basis for diagnosis.

Appendix Table VI shows (a) the percentage distributions of pregnancy terminations and the probabilities of terminations within a specified week when the date of termination is the date of final diagnosis of fetal death and (b) the corresponding percentage distributions and probabilities when the earliest date of probable fetal death is used to calculate gestation age. Comparison of these figures indicates that there is very little change in the probability curves; the re-calculation results in a very slight shift toward earlier gestation age in the curves relating to fetal deaths, but no important change in the shape of the curve or the week of peak incidence. This suggests that medical records of the type studied in this report will yield about

Appendix Table VI. Selected life table values for pregnancy terminations.

A. DATE OF TERMINATION OF FETAL DEATH TAKEN AS DATE OF FINAL DIAGNOSIS OF FETAL DEATH

Gestation Age (Completed Weeks)	Total Pregnancies	Fetal Deaths	Per Cent of All Pregnancies Ending at Specified Gestation Age in A:		Per Cent of All Pregnancies of Specified Gestation Age ¹ Terminating at That Age in A:	
			Live Birth or Fetal Death (dx)	Fetal Death	Live Birth or Fetal Death (qx)	Fetal Death
ALL AGES	6,844	970	100.00	14.17	—	—
2	2	2	0.03	0.03	0.03	0.03
3	6	6	0.09	0.09	0.10	0.10
4	8	8	0.12	0.12	0.13	0.13
5	14	14	0.20	0.20	0.22	0.22
6	29	29	0.42	0.42	0.46	0.46
7	41	41	0.60	0.60	0.65	0.65
8	51	51	0.75	0.75	0.82	0.82
9	97	97	1.42	1.42	1.57	1.57
10	115	115	1.68	1.68	1.90	1.90
11	102	102	1.49	1.49	1.72	1.72
12	85	85	1.24	1.24	1.45	1.45
13	68	68	0.99	0.99	1.18	1.18
14	50	50	0.73	0.73	0.87	0.87
15	31	31	0.45	0.45	0.56	0.56
16	23	23	0.34	0.34	0.41	0.41
17	25	25	0.37	0.37	0.45	0.45
18	18	18	0.26	0.26	0.33	0.33
19	12	12	0.18	0.18	0.22	0.22
20	12	10	0.18	0.15	0.22	0.18
21	17	15	0.25	0.22	0.30	0.27
22	9	6	0.13	0.09	0.17	0.12
23	7	5	0.10	0.07	0.12	0.08
24	10	5	0.15	0.07	0.17	0.08
25	15	8	0.22	0.12	0.27	0.15
26	11	7	0.16	0.10	0.20	0.13
27	4	—	0.06	—	0.07	—
28	9	5	0.13	0.07	0.15	0.08
29	9	1	0.13	0.01	0.15	0.02
30	15	4	0.22	0.06	0.25	0.07
31	19	3	0.28	0.04	0.32	0.05
32	22	1	0.32	0.01	0.38	0.02
33	27	2	0.39	0.03	0.46	0.03
34	41	5	0.60	0.07	0.71	0.09
35	85	6	1.24	0.09	1.49	0.12
36	158	6	2.31	0.09	2.82	0.12
37	301	4	4.40	0.06	5.47	0.07
38	723	5	10.56	0.07	13.91	0.10
39	1,306	5	19.08	0.07	29.17	0.11
40	1,512	6	22.09	0.09	47.71	0.22
41	977	6	14.28	0.09	58.98	0.42
42	410	2	5.99	0.03	60.32	0.29
43	143	—	2.09	—	52.77	—
44	65	—	0.95	—	50.78	—
45	34	—	0.50	—	53.97	—
46 or More	29	1	0.42	0.01	100.00	*
Age Not Stated	97	75	1.42	1.10	—	—

¹ Gestation age "not stated" distributed.

Appendix Table VI (Continued)

**B. DATE OF TERMINATION OF FETAL DEATH TAKEN AS DATE OF EARLIEST REPORT
OF PROBABLE FETAL DEATH**

Gestation Age (Completed Weeks)	Total Pregnancies	Fetal Deaths	Per Cent of All Pregnancies Ending at Specified Gestation Age in A:		Per Cent of All Pregnancies of Specified Gestation Age ¹ Terminating at That Age in A:	
			Live Birth or Fetal Death (d _z)	Fetal Death	Live Birth or Fetal Death (q _z)	Fetal Death
ALL AGES	6,844	970	100.00	14.17	—	—
2	2	2	0.02	0.02	0.02	0.02
3	11	11	0.16	0.16	0.18	0.18
4	6	6	0.09	0.09	0.10	0.10
5	14	14	0.20	0.20	0.22	0.22
6	32	32	0.47	0.47	0.51	0.51
7	42	42	0.61	0.61	0.68	0.68
8	54	54	0.79	0.79	0.88	0.88
9	102	102	1.49	1.49	1.66	1.66
10	118	118	1.72	1.72	1.97	1.97
11	96	96	1.40	1.40	1.62	1.62
12	87	87	1.27	1.27	1.49	1.49
13	70	70	1.02	1.02	1.22	1.22
14	48	48	0.70	0.70	0.84	0.84
15	31	31	0.45	0.45	0.56	0.56
16	22	22	0.32	0.32	0.40	0.40
17	27	27	0.39	0.39	0.48	0.48
18	13	13	0.19	0.19	0.23	0.23
19	11	11	0.16	0.16	0.20	0.20
20	15	13	0.22	0.19	0.27	0.23
21	15	13	0.22	0.19	0.27	0.23
22	10	7	0.15	0.10	0.18	0.13
23	7	5	0.10	0.07	0.12	0.08
24	10	5	0.15	0.07	0.17	0.08
25	14	7	0.20	0.10	0.25	0.13
26	8	4	0.12	0.06	0.14	0.07
27	4	—	0.06	—	0.07	—
28	6	2	0.09	0.03	0.10	0.03
29	10	2	0.15	0.03	0.17	0.03
30	15	4	0.22	0.06	0.25	0.07
31	19	3	0.28	0.04	0.32	0.05
32	22	1	0.32	0.01	0.38	0.02
33	26	1	0.38	0.01	0.45	0.02
34	44	8	0.64	0.12	0.78	0.16
35	83	4	1.21	0.06	1.44	0.07
36	156	4	2.28	0.06	2.77	0.07
37	304	7	4.44	0.10	5.54	0.14
38	721	3	10.53	0.04	13.89	0.06
39	1,305	4	19.07	0.06	29.18	0.09
40	1,510	4	22.06	0.06	47.69	0.13
41	977	6	14.28	0.09	59.05	0.42
42	410	2	5.99	0.03	60.50	0.29
43	143	—	2.09	—	53.16	—
44	65	—	0.95	—	51.59	—
45	34	—	0.50	—	55.74	—
46 or More	28	—	0.41	—	100.00	—
Age Not Stated	97	75	1.42	1.10	—	—

the same estimate of probability of fetal death according to gestation age regardless of date selected for coding the termination of pregnancy. For determining more exact time of fetal death, a different approach and different kinds of information are required.