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Vital Signs Present at Birth

Report of a study of vital signs present at birth as observed in the delivery rooms of five hospitals, and a study of the relationship of these signs of life to definitions of live birth and fetal death used for vital registration purposes; comparison of rates based on the study data according to alternate definitions which include various combinations of vital signs present at birth.

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VITAL SIGNS PRESENT AT BIRTH

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INTRODUCTION

In demographic and epidemiologic studies of infant mortality, vital statistics rates such as fetal death rates or infant or neonatal mortality rates are often compared. The basic data needed for compiling and computing such rates are the numbers of infant, neonatal, and fetal deaths and the number of live births. The basic data are derived from vital records which, in the United States, are kept on permanent file in the States in accordance with State statutes.

In some recent international studies of perinatal and infant mortality, considerable attention has been paid to the comparability of data and definitions.[1-3] It was recognized that the definitions of "live birth" and "fetal death" were matters of basic importance to the statistics. At time of birth, the attendant must decide, on the basis of certain evidence, if the infant is live born. His decision is reflected in a live birth or a fetal death certificate, and he determines the category to which the event is allocated statistically. Fortunately, the attendant has no difficulty in arriving at a decision for the great majority of deliveries: the offspring is unquestionably born alive and survives. At times, however, the attendant must refer to the definitions of vital events to arrive at a decision regarding the type of vital record which must be filed.

Official definitions of live birth and fetal death were approved and recommended for use in all countries by the Third World Health Assembly in 1950 and were recommended for use in all States of the United States by the Surgeon General of the Public Health Service. Following this action, the international recommendations were incorporated into the laws and regulations of almost all of the States in this country and are regarded as the official definitions to be followed for vital registration. As a natural consequence, these particular definitions affect the vital statistics of individual States and the country as a whole.

The recommended definition of *live birth* is:

> "Live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which, after such separation, breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live born."[4]

The definition of *fetal death* is the complement of the definition of live birth:

> "Foetal death is death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation, the foetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles."[4]

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At the time a pregnancy terminates, each conceptus should be assigned to one of the two groups based on the vital signs present at time of birth: it is either a live birth (liveborn infant) or a fetal death (all other pregnancy terminations). The terms "live birth" and "fetal death" relate to each conceptus so that a single pregnancy may result in one live birth and one fetal death when twins are involved. It is important to note that the definition of live birth stipulates that if any one of four vital signs is observed at birth, the infant shall be registered as a liveborn infant.

In practice, the same event could be interpreted somewhat differently, or the definition could be applied slightly differently by different physicians. When one considers that over 3.5 million live births and over 50,000 fetal deaths with gestation periods of 20 weeks or more are registered annually throughout the United States, occasional differences of opinion are bound to occur as to whether certain births should be registered as live births or as fetal deaths. Although these occasional disparities exist, they assume practical importance in a statistical sense insofar as they occur often enough to affect the vital statistics rates. It is important, therefore, to estimate how often such events occur and to estimate their potential effect on fetal death rates or on neonatal, perinatal, or infant mortality rates.

In 1966 the National Center for Health Statistics (NCHS) contracted with the Medical and Health Research Association of New York City, Inc., to investigate the problems associated with the definitions of "live birth" and "fetal death," and the resulting rates. That city was selected as the site for the study because of its longstanding reputation as having one of the most complete registration systems in the country insofar as live births and fetal deaths are concerned.

Two exploratory efforts were undertaken. First, 2,300 fetal death records for pregnancies with gestation periods of 28 completed weeks or more were reviewed to determine whether there were indications anywhere on the records that the infants were born alive. Only one such record was found, and for that birth, a fetal death, live birth, and death record had all been filed. In addition, two fetal death records were found for each of nine deliveries. Thus among these 2,300 fetal death records, 10 superfluous fetal death records were found, but only one appeared to be related to some question about whether the infant was born alive.

A second exploratory effort was undertaken to determine whether the desired information could be obtained retrospectively from existing hospital records. Small groups of patients' records in three hospitals were reviewed in detail. These included records for 238 live births and 172 fetal deaths with gestation periods of 28 weeks or more. Specifics regarding signs of life were not found in sufficient detail in the hospital records.

It was concluded from these two reviews that neither the existing vital records nor the existing hospital records contained the desired information in a satisfactorily complete and consistent fashion. Following the two exploratory investigations, it was decided to pursue the problem in a prospective study by direct observation of a group of deliveries, including the careful recording of vital signs observed at birth.

PURPOSES OF STUDY

The present investigation was undertaken with a number of objectives in mind. One objective was statistical, i.e., to determine the quantitative effect of using different combinations of vital signs to define live births. To accomplish this purpose, it was necessary to obtain information on the four specified vital signs for a group of births. With careful observation, one could document the vital signs for a consecutive series of births and use the observed results to compute rates for analytical purposes.

Another objective was methodological, i.e., to demonstrate the feasibility of conducting such studies amid the daily routine of hospitals. The vast majority of live births and fetal deaths with gestation periods of 28 weeks or more occur in hospitals. For international comparisons of infant and perinatal mortality, this group of pregnancy terminations are of particular relevance because only fetal deaths with gestation periods of 28 weeks or more are required to be registered in other countries.

STUDY PROCEDURES

The study method consisted of the direct observation of a number of deliveries to record

the signs of life observed within 2 minutes after birth. To avoid selection of cases by the observers, personnel were provided on a round-the-clock basis to witness consecutive series of deliveries. Five hospitals in New York City participated in the study: three municipal and two voluntary hospitals. The first delivery was observed in May 1967 and the last in July of the same year. Observers were instructed to witness every delivery in the delivery rooms and every cesarean section in the surgical suites.

Since the observers were required to be present in the delivery rooms at the time of delivery, it was not possible to use individuals unrelated to the hospital staffs. Instead, a member of the obstetric team was assigned to act as observer, and that member was often a resident, intern, or medical student. In one of the hospitals, the observer was the accoucheur.

The observations were recorded independently of the regular record-keeping activities of the usual delivery room staff. Although objective and completely independent observations were desired, it was recognized that because of the selection of observers as described above, this would not be entirely possible. Furthermore, it was not always possible for the observer to be close enough to the infant at the moment of delivery to detect the signs of life firsthand, and some unmeasured amount of indirect information was included. By verbal report, such instances were rare.

The four signs of life which were to be specifically noted were those included in the official definition of live birth, i.e., breathing, heartbeat, pulsation of the umbilical cord, and definite movement of voluntary muscles. The observers determined the respiratory effort and movement of voluntary muscles by visual means. The presence or absence of heartbeat was observed by palpation at the apex of the heart, and if no heartbeat was detected, an attempt was made to detect the heartbeat by auscultation. Pulsation of the umbilical cord was determined by palpation. All of the signs were required to be observed within 2 minutes after the fetus was separated from the body of its mother, and pulsation of the umbilical cord was recorded only up to the time immediately after the cord had been tied if that occurred before 2 minutes had elapsed. A vital sign was considered absent if it failed to manifest itself within 2 minutes following delivery. A copy of the recording form is shown in Appendix I. The completed study forms were forwarded to the City of New York Department of Health at weekly or biweekly intervals.

In addition to the form which was completed by the observer, a coding sheet was used at the Department of Health to abstract information from the corresponding official vital records. The Health Code of the City of New York requires the registration of all products of conception irrespective of gestation; therefore, each of the events observed in the delivery rooms was required to have a vital record on file. Comparison of the study forms with the vital records for the study period was included to determine how well the definitions of the World Health Organization (WHO) were applied in the everyday working situation.

Following the receipt of the study forms in the Department of Health, a search was made for the corresponding birth or fetal death certificates. In addition, reference was made to the weekly lists of deaths among children under 1 year of age which are prepared by the Department. From the lists for the five study hospitals, all deaths which occurred in the first 7 days of life among the study infants born in the same hospitals were abstracted, and the information was entered on the coding sheet. In this cross-check, the assumption was made that deaths which occur during the first week of life occur in the same hospital in which the birth occurs. This assumption was felt to be reasonable by the project staff.

Later, vital signs were coded using a maximum 16-unit code which covered all possible combinations of the four vital signs. In some tables in this report, vital signs are denoted by a single letter representing each of the signs: respiratory effort (R), pulsation of the umbilical cord (P), movement of voluntary muscles (M), and heartbeat (H). All data on the presence of vital signs refer only to the 2 minutes after separation of the fetus from its mother or for pulsation of the umbilical cord the shorter interval described earlier. For some infants, signs which were not observed during this 2-minute interval appeared subsequently and will be commented on later in this report.

The ethnic groups are classified for the purpose of this study as follows:

White.—Includes 1,015 infants; excludes those with mothers born in Latin America.

Negro.—Includes 946 infants; excludes those with mothers born in Latin America.

Other.—Includes 661 infants· 535 to mothers born in Puerto Rico, 106 to mothers born in other Latin American countries, and 20 others.

This classification does not correspond exactly with the categories which are generally used for demographic or health statistics, nor with the ethnic code generally used in the Department of Health.

RESULTS OF STUDY

A total of 2,629 events which came within the scope of the study occurred in the study period at the five selected hospitals; seven of these were excluded. One case was excluded because a vital record was not filed and six because a study form was not filed on time, or was incomplete. Because of the desire to compare information from the two sources of information, these seven incomplete cases were rejected.

Table 1. Number and percentage distribution of deliveries by ethnic group, and WHO classification based on vital signs: five selected hospitals in New York City, May-July, 1967

Ethnic group	All deliveries	Live births	Fetal deaths
	Number		
Total	2,622	2,565	57
White[1]	1,015	1,007	8
Negro[1]	946	915	31
Other[2]	661	643	18
	Percentage distribution		
Total	100.0	97.8	2.2
White[1]	100.0	99.2	0.8
Negro[1]	100.0	96.7	3.3
Other[2]	100.0	97.3	2.7

[1] Except those with mothers born in Latin America.

[2] Includes 535 mothers born in Puerto Rico, 106 in other Latin American countries, 20 others.

The remaining 2,622 vital events, when classified by the WHO criteria, represented 2,565 live births and 57 fetal deaths of all gestations. The distribution of the events by ethnic group is shown in table 1: the two largest groups were white (39 percent) and Negro (36 percent), with the residual category constituting 25 percent of the total study group. Fetal deaths form a higher proportion of the deliveries for the Negro and other groups than for the white.

The distribution of all deliveries by hospital and WHO definition are shown in table 2. The proportions of fetal deaths are greater among the deliveries in the three municipal hospitals than among those in the two voluntary hospitals, probably due to the greater proportion of Negro and Latin American clients in municipal hospitals.

Table 2. Number and percentage distribution of deliveries by hospital, and WHO classification based on vital signs: five selected hospitals in New York City, May-July, 1967

Hospital	All deliveries	Live births[1]	Fetal deaths[2]
	Number		
Total	2,622	2,565	57
Municipal			
A	320	314	6
B	568	548	20
C	619	594	25
Voluntary			
D	856	851	5
E	259	258	1
	Percentage distribution		
Total	100.0	97.8	2.2
Municipal			
A	100.0	98.1	1.9
B	100.0	96.5	3.5
C	100.0	96.0	4.0
Voluntary			
D	100.0	99.4	0.6
E	100.0	99.6	0.4

[1] One or more vital signs present (WHO classification).

[2] No vital sign present.

A complete tabulation of all recorded combinations of vital signs which were present among the 2,622 deliveries is shown by hospital in table 3. For the great majority of cases in each hospital, all four vital signs were present. Combinations which are not listed did not occur.

The total number of times each of the four vital signs was present is shown in table 4. Among the 2,622 deliveries, there were 57 fetuses which exhibited none of the four vital signs. These deliveries were classified as fetal deaths according to the WHO definition; the remaining 2,565 deliveries were classified as live births since one or more of the four vital signs were present. Of the four signs, heartbeat was recorded as present for 2,564 of the 2,565 live births. Next in order of magnitude was respiratory effort, which was present for 97.4 percent of live births, followed by movement of voluntary muscles (97.2 percent) and pulsation of umbilical cord (96.8 percent).

Table 3. Combinations of vital signs present for all deliveries, by hospital: five selected hospitals in New York City, May-July, 1967

Vital sign present[1]	Total	Hospital				
		A	B	C	D	E
Total	2,622	320	568	619	856	259
None[2]	57	6	20	25	5	1
One or more[3]	2,565	314	548	594	851	258
RPMH	2,389	286	529	550	819	205
PMH	24	2	6	1	11	4
RMH	65	-	-	21	2	42
RMH($\bar{P}$)[4]	11	6	-	-	-	5
MH	5	-	-	4	-	1
RPH	32	4	5	11	12	-
PH	27	11	8	2	5	1
RH	1	-	-	1	-	-
H	10	4	-	4	2	-
P	1	1	-	-	-	-

[1] R=respiratory effort; P=pulsation of umbilical cord; M=movement of voluntary muscles; H=heartbeat.
[2] Classified as fetal deaths (WHO definition).
[3] Classified as live births (WHO definition).
[4] For these 11 cases, pulsation of umbilical cord was not recorded as present or absent.

Table 4. Number of times each vital sign was present for all deliveries: five selected hospitals in New York City, May-July, 1967

Vital sign	Observation recorded	Vital sign		Vital sign present	
		Present	Absent	Percent of all deliveries	Percent of live births
All deliveries	2,622	2,565	[1]57	100.0	...
Live births	...	2,565	...	...	100.0
Respiratory effort	2,565	2,498	67	95.3	97.4
Pulsation of umbilical cord[2]	2,554	2,473	81	94.7	96.8
Movement of voluntary muscles	2,565	2,494	71	95.1	97.2
Heartbeat	2,565	2,564	1	97.8	100.0

[1] Classified as fetal deaths (WHO definition), no vital sign present.
[2] Excludes 11 cases for which pulsation of umbilical cord was not recorded as present or absent.

The vital signs noted at birth are shown for the total deliveries by gestation in table 5, and by weight at birth in table 6. The distributions of deliveries with no vital sign present were skewed toward the lower ends of both the gestation and birth weight scales. Among the deliveries with vital signs present, there was relatively little difference among the distributions in either table. The largest difference, although it is not large, was between respiratory effort and heartbeat according to birth weight: small infants, those weighing 1,000 grams or less at birth, constituted 0.5 percent of the group with observed respiratory effort and 1.1 percent of the group with an observed heartbeat. Among these small infants, respiratory effort was either not as readily observed or was not established as soon after birth as heartbeat. The differences at other weight groups were of small order.

Definition of Live Birth

The definition of live birth and its effect on the registration of vital events has long troubled vital statisticians.[5-13] When the WHO definition was constructed for worldwide use, it was recognized that the vast majority of deliveries in some countries occur in hospitals, while in others quite the reverse is true. To be internationally useful, the definition had to be applicable to this wide diversity of situations.

The WHO definition of live birth encompasses all infants who demonstrate any evidence of life at time of birth even though they may die very soon thereafter. The definitions of live birth and fetal death were clear enough, it was felt, so that if they were applied uniformly in all countries, comparable birth and perinatal statistics could be produced for international comparisons. If, on the other hand, countries were to continue to

Table 5. Vital signs present among deliveries by period of gestation: five selected hospitals in New York City, May-July, 1967

Period of gestation (completed weeks)	No vital sign present	One or more vital signs present (WHO definition)	Respiratory effort	Pulsation of umbilical cord[1]	Movement of voluntary muscles	Heartbeat
Total	57	2,565	2,498	2,473	2,494	2,564
Under 20	7	3	3	1	2	3
20-27	21	20	13	18	12	20
28-35	11	272	256	257	253	271
36-39	10	1,122	1,105	1,092	1,105	1,122
40-44	3	743	733	721	732	743
42 and over	5	344	333	325	334	344
Not stated	-	61	55	59	56	61

[1] Excludes 11 cases for which pulsation of umbilical cord was not recorded as present or absent.

Table 6. Vital signs present among deliveries by weight at birth: five selected hospitals in New York City, May-July, 1967

Birth weight (grams)	No vital sign present	One or more vital signs present (WHO definition)	Respiratory effort	Pulsation of umbilical cord[1]	Movement of voluntary muscles	Heartbeat
Total	57	2,565	2,498	2,473	2,494	2,564
1,000 or less	27	28	13	23	14	27
1,001-1,500	7	32	30	30	28	32
1,501-2,500	10	239	228	228	224	239
2,501-4,000	8	2,149	2,112	2,081	2,113	2,149
4,001 or more	2	116	115	110	115	116
Not stated	3	1	-	1	-	1

[1] Excludes 11 cases for which pulsation of umbilical cord was not recorded as present or absent.

use different criteria for determining live birth, it could affect not only the number of live births but the number of fetal deaths and neonatal deaths as well.

It is obvious that, as long as all pregnancy terminations are divided into a dichotomy of live births and fetal deaths, the definitions will affect the number of fetal deaths as well as the number of live births. The effect of the definitions on the number of neonatal deaths is less obvious: if a liveborn infant dies soon after birth (within minutes, perhaps), that death must be considered a neonatal death as well. Thus, once a determination is made regarding the birth, the number of neonatal deaths is also affected.

In the present study, the application of the WHO definition which accepts one or more of four vital signs to be indicative of live birth resulted in 2,565 liveborn infants, 57 fetal deaths, and 40 deaths in the first week of life (table 7). A definition which considers only heartbeat as a necessary criterion of live birth would have yielded virtually the same results: 2,564 live births, 58 fetal deaths, and 39 deaths in the first week of life. Another older definition, which mentioned only respiratory effort as indicative of live birth, would have yielded quite different results: 2,498 live births, 124 fetal deaths, and 22 deaths in the first week of life.

The last line in table 7 presents the data when even another definition for live birth is used—i.e., that *all four* vital signs must be present in the first 2 minutes of life before an infant is deemed to be liveborn. Using all four criteria, the data would change markedly: the number of live births would decline to 2,389, and "fetal deaths" would increase to 222. Among the latter, 57 had no vital sign present at birth and are unquestionably fetal deaths. In the remaining 165 cases with 1-3 signs present, 18 died during the first week of life and 147 survived that period; these are obviously not fetal deaths. This combination of vital signs as a definition of live birth is, therefore, unacceptable.

The number of live births and fetal deaths resulting from every combination of the four signs of life is shown in table 8. The last three columns contain the ratios of the number of events classified according to each of the definitions to the number of events classified according to the WHO definition. Varying combinations of vital signs to be observed for alternate definitions of live birth affects the number of live births relatively little: at most, they are understated by 3 percent. In some instances, however, the number of fetal deaths is more than doubled, and the number of deaths in the first week of life is reduced almost by half.

Table 7. Allocation of deliveries to live births, fetal deaths, and deaths in the first week of life according to vital signs included in various definitions of live birth: five selected hospitals in New York City, May-July, 1967

Alternate definitions of live birth	Total deliveries	Live births	Vital signs missing among all deliveries						Deaths in first week
			Total	Specified sign missing	All signs missing				
					Total	20 weeks or less	20-27 weeks	28 weeks or more	
Specified vital sign required:									
Respiratory effort	2,622	2,498	124	67	57	7	21	29	22
Pulsation of umbilical cord[1]	2,611	2,473	138	81	57	7	21	29	33
Movement of voluntary muscles	2,622	2,494	128	71	57	7	21	29	24
Heartbeat	2,622	2,564	58	1	57	7	21	29	39
One or more vital signs (WHO definition)	2,622	2,565	57	-	57	7	21	29	40
All vital signs[1]	2,611	2,389	222	165	57	7	21	29	18

[1] Excludes 11 cases for which pulsation of umbilical cord was not recorded as present or absent.

Table 8. Number of vital events determined by alternate vital signs and ratio to events determined by WHO definition: five selected hospitals in New York City, May-July, 1967

Vital sign(s) to be observed for alternate definitions of live birth	Live births	Fetal deaths	Deaths in first week	Ratio to events identified by WHO definition		
				Live births	Fetal deaths	Deaths in first week
Only one sign required						
(R) Respiratory effort	2,498	124	22	0.97	2.18	0.55
(P) Pulsation of umbilical cord[1]	2,473	138	33	0.97	2.42	0.83
(M) Movement of voluntary muscle	2,494	128	24	0.97	2.25	0.60
(H) Heartbeat	2,564	58	39	1.00	1.02	0.98
Any of the following						
R or P	2,550	72	33	0.99	1.26	0.83
R or M	2,527	95	28	0.99	1.67	0.70
R or H	2,564	58	39	1.00	1.02	0.98
P or M	2,554	68	37	1.00	1.19	0.93
P or H	2,565	57	40	1.00	1.00	1.00
M or H	2,564	58	39	1.00	1.02	0.98
R, P, or M	2,555	67	37	1.00	1.18	0.93
R, P, or H	2,565	57	40	1.00	1.00	1.00
R, M, or H	2,564	58	39	1.00	1.02	0.98
P, M, or H	2,565	57	40	1.00	1.00	1.00
R, P, M, or H (WHO definition)	2,565	57	40	1.00	1.00	1.00

[1] Excludes 11 cases for which pulsation of the umbilical cord was not recorded as present or absent.

The purpose of the structured WHO definitions of live birth and fetal death is to assist in determining *at time of birth* whether a delivery is to be classified as a live birth or a fetal death. If the status of the infant is to be determined at time of birth, it seems axiomatic that the observations need to be made as soon as the infant is completely separated from its mother. For the purpose of this study, a 2-minute interval was assigned to the observers as the period within which the signs of life were to be recorded as signs of life "at time of birth." It was felt that if specific signs did not manifest themselves within that period, they would remain absent. However, the data demonstrated that some of the vital signs do not manifest themselves within 2 minutes of birth in all infants, even in those infants who survive the first week of life (table 9). For example, 67 of 2,565 infants who showed any of the four signs of life failed to demonstrate respiratory effort in the first 2 minutes of life. Of the 67 infants, six died within an hour of birth, 10 died in the remainder of the first day, two died in the remainder of the first week, and 49 survived the first week of life. It is obvious, therefore, that breathing within 2 minutes of birth, taken as the sole criterion of life, is unsatisfactory.

The data in table 9 demonstrate that if either pulsation of umbilical cord or movement of voluntary muscles in the first 2 minutes is the sole determinant of life at birth for registration purposes, even greater numbers of questionable cases are encountered than when respiratory effort is the sole criterion of live birth. The only vital sign which discriminated well was heartbeat: only one of the 2,565 infants failed to demonstrate a heartbeat within 2 minutes of

Table 9. Vital signs which were missing during the first 2 minutes of life among selected categories of 2,565 live births by survival of infant: five selected hospitals, New York City, May-July, 1967

Event	No respiratory effort	No pulsation of umbilical cord	No movement of voluntary muscles	No heartbeat
Live birth (WHO definition)	67	81	71	1
Death:				
Under one hour	6	2	8	1
1-23 hours	10	5	7	-
1-6 days	2	-	1	-
Survived first week	49	74	55	-

birth, but showed another sign of life during that interval. That infant died later in the first hour of life.

Effect on Vital Statistics Rates

The data shown in tables 1-8 include all 2,622 births in the study group. According to the WHO definition, 2,565 were live births and 57 were fetal deaths of all gestations. The requirement to register fetal deaths of all gestations is not typical of the registration requirements of most States or of other countries. National statistics and the statistics for most States in the United States include only those fetal deaths with gestation periods of 20 completed weeks or more. When the data from the present study were rearranged in accord with these criteria, it became apparent that very few fetal deaths of less than 20 completed weeks of gestation were observed in delivery rooms (table 7). The large number of fetal deaths which were expected with gestation periods of less than 20 weeks were apparently born elsewhere—either outside hospitals or occasionally in other parts of hospitals (e.g., surgery, emergency rooms)—and are therefore not part of this study. In registration areas requiring the registration of fetal deaths irrespective of gestation, the omission of these vital events is of serious statistical consequence.

The consideration of definitions of live birth is not entirely an end in itself. Its purpose here is in relation to the vital statistics rates which are produced. According to earlier definitions of live birth, breathing at time of birth was the only specified criterion of life. In the preceding section, it was demonstrated that if this criterion was strictly adhered to, 67 of 2,565 infants who were classified as live births according to the WHO definition did not breathe in the first 2 minutes of life (table 9) and would not be considered as having been born alive. How would these 67 vital events have been registered? If they were not liveborn, by definition they were fetal deaths, and their registration would depend on local requirements. In most States, if the period of gestation is 20 completed weeks or more, they should be registered as fetal deaths; if less than that period, they need not be registered at all.

Although the weakness of depending on definitions based on single criteria of life has been mentioned, it is interesting to assess the effect the definitions would have on some of the commonly used vital statistics rates. These rates are not shown in this report as illustrations of rates in actual populations. They are presented to demonstrate the implications of strict application of the criteria of live birth to specific vital events and strict application of these events within the structure of vital statistics rates. The methods of computation are shown in Appendix II. The data in table 10 are presented in relationship to registration practice in effect for most of the United States; that is, they include only those fetal deaths with gestation periods of

Table 10. Fetal and early neonatal mortality rates and ratios for each combination of vital signs: five selected hospitals in New York City, May-July, 1967

Vital sign(s) to be observed for alternate definitions of live birth	Births with one or more specified sign(s) present	Births with all specified sign(s) absent, others present[1]	Births with all 4 signs absent[1] (fetal deaths)	Fetal death rate[1]	Fetal death ratio[1]	Deaths in first week	Mortality rate in first week
	col. A	col. B	col. C	cols. B+C / cols. A+B+C	cols. B+C / col. A	col. D	col. D / col. A
Only one vital sign	Number			Rate per 1,000		Number	Rate per 1,000
(R) Respiratory effort	2,498	67	50	44.7	46.8	22	8.8
(P) Pulsation of umbilical cord[2]	2,473	80	50	49.9	52.6	33	13.3
(M) Movement of voluntary muscles	2,494	70	50	45.9	48.1	24	9.6
(H) Heartbeat	2,564	1	50	19.5	19.9	39	15.2
Any of the following							
R or P	2,550	15	50	24.9	25.5	33	12.9
R or M	2,527	38	50	33.7	34.8	28	11.1
R or H	2,564	1	50	19.5	19.9	39	15.2
P or M	2,554	11	50	23.3	23.9	37	14.5
P or H	2,565	-	50	19.1	19.5	40	15.6
M or H	2,564	1	50	19.5	19.9	39	15.2
R, P, or M	2,555	10	50	22.9	23.5	37	14.5
R, P, or H	2,565	-	50	19.1	19.5	40	15.6
R, M, or H	2,564	1	50	19.5	19.9	39	15.2
P, M, or H	2,565	-	50	19.1	19.5	40	15.6
R, P, M, or H (WHO definition)	2,565	-	50	19.1	19.5	40	15.6

[1] Gestation periods of 20 completed weeks or more.
[2] Excludes 11 cases for which this item was not recorded as present or absent.

20 completed weeks or more. Included as live births (column A) are all births that exhibited the specified combinations of vital signs shown in the stub of the table. Those infants that did not exhibit the specified vital signs would be *registered* as fetal deaths only if they completed 20 weeks of gestation (column B). The number of infants who exhibited no vital sign but whose periods of gestation were 20 completed weeks or more would remain constant (column C). The fetal death rates and ratios are computed from the first 3 columns. From the table, it is obvious that the greatest numerical variation is in column B, which reflects the variation one might expect for infants who exhibited one or more, but not all, signs of life.

If respiratory effort were the only vital sign which would be considered to classify an infant as liveborn and all other infants were classified as fetal deaths, the fetal death rate would be 44.7 per 1,000 live births and fetal deaths having gestation periods of 20 completed weeks or more. For the next two vital signs (pulsation of the umbilical cord, movement of the voluntary muscles) the rates were somewhat, but not much, higher—49.9 and 45.9, respectively. However, if heartbeat were the only vital sign considered in defining live birth, the fetal death rate would be less than half the rate for any of the other three signs of life—19.5 per 1,000. As expected, this rate is rather close to the rate obtained when any of the four vital signs is considered to signify life; adhering to the WHO definition, the fetal death rate would be 19.1 per 1,000.

The mortality rate for the first week of life would also show wide variation. The mortality rate when heartbeat was the only vital sign considered to define live birth (15.2) was close to the rate obtained using the WHO definition (15.6). The greatest differences were for the definitions which considered only respiratory effort or movement of voluntary muscles to define live birth—8.8 and 9.6, respectively.

In addition to the wide variation in the rates which would be introduced by strict adherence to observing only certain sign(s) of life, the problem of what to do with the births exhibiting other signs of life remains. The births shown in column B of table 10 would not be considered

live births under the specified criteria, but neither are they fetal deaths. The larger the number of births with some, but not all, of the signs of life (column B), the less satisfactory is that definition of live birth.

It has long been accepted that differences in rates are found depending on the vital signs used to define a live birth, but the magnitude of the differences has been largely unknown. It has been thought that the major discrepancy was due to allocating some live births to fetal deaths and *vice versa.* To overcome this difficulty, perinatal rates (or ratios) have been proposed. For the numerator of a perinatal rate, fetal deaths of specified gestation periods and early neonatal deaths of specified ages are summed. The rationale is that by summing them, borderline decisions about live birth and fetal death are avoided. The denominator is the sum of the live births and the fetal deaths which are represented in the numerator.

One perinatal mortality rate which is commonly used for international comparisons combines fetal deaths with gestation periods of 28 completed weeks or more with deaths in the first week of life for the numerator and combines the live births and fetal deaths with gestation periods of 28 completed weeks or more for the denominator. By convention, the result is multiplied by 1,000. This rate has been advocated within the framework of using the WHO definitions of live birth and fetal death. The present study provides an opportunity to examine the perinatal mortality rates under strict application of each of the combinations of vital signs, and the components of the vital statistics rates.

Perinatal mortality rates and ratios for the present study are shown in table 11. As before, when heartbeat alone or heartbeat in combination with other vital signs were deemed to qualify an infant as liveborn, the rates were very close; in fact, for perinatal mortality, the rates were identical (26.6). However, when any one of the other three vital signs alone was deemed sufficient to define a live birth, the perinatal mortality rates were markedly higher—respiratory effort, 42.9; pulsation of the umbilical cord, 53.9; and movement of voluntary muscles, 44.5. The ratio of the highest perinatal mortality rate to the lowest rate was 2.0, and the marked difference was due to the numerical variation shown in column B. As in the previous table, the larger the entry in this column, the less satisfac-

Table 11. Selected mortality rates and ratios for each combination of vital signs: five selected hospitals in New York City, May-July, 1967

Vital sign(s) to be observed for alternate definitions of live birth	Births with one or more specified sign(s) present	Births with all specified sign(s) absent, others present[1]	Births with all 4 signs absent[1] (fetal deaths)	Deaths in first week with one or more specified sign(s) present	Fetal death rate	Fetal death ratio	Mortality rate in first week	Perinatal mortality rate	Perinatal mortality ratio
	col. A	col. B	col. C	col. D	cols. B+C / cols. A+B+C	cols. B+C / col. A	col. D / col. A	cols. B+C+D / cols. A+B+C	cols. B+C+D / col. A
	Number				Rate per 1,000				
Only one vital sign									
(R) Respiratory effort	2,498	60	29	22	34.4	35.6	8.8	42.9	44.4
(P) Pulsation of umbilical cord[2]	2,473	77	29	33	41.1	42.9	13.3	53.9	56.2
(M) Movement of voluntary muscles	2,494	62	29	24	35.2	36.5	9.6	44.5	46.1
(H) Heartbeat	2,564	1	29	39	11.6	11.7	15.2	26.6	26.9
Any of the following									
R or P	2,550	12	29	33	15.8	16.1	12.9	28.6	29.0
R or M	2,527	32	29	28	23.6	24.1	11.1	34.4	35.2
R or H	2,564	1	29	39	11.6	11.7	15.2	26.6	26.9
P or M	2,554	9	29	37	14.7	14.9	14.5	28.9	29.4
P or H	2,565	-	29	40	11.2	11.3	15.6	26.6	26.9
M or H	2,564	1	29	39	11.6	11.7	15.2	26.6	26.9
R, P or M	2,555	8	29	37	14.3	14.5	14.5	28.5	29.0
R, P or H	2,565	-	29	40	11.2	11.3	15.6	26.6	26.9
R, M or H	2,564	1	29	39	11.6	11.7	15.2	26.6	26.9
P, M or H	2,565	-	29	40	11.2	11.3	15.6	26.6	26.9
R, P, M or H (WHO definition)	2,565	-	29	40	11.2	11.3	15.6	26.6	26.9

[1] Gestation periods of 28 completed weeks or more.
[2] Excludes 11 cases for which this item was not recorded as present or absent.

tory were the specified criteria as a definition of live birth.

From these data, one must conclude that perinatal mortality rates and ratios do not entirely overcome the statistical artifacts introduced by differences in definitions of live birth based on selected vital signs. The variation between rates shown in table 11 reemphasizes the necessity for *standard* logical definitions and their *uniform application* to produce comparable statistics.

Registration

A secondary objective of the present study was to compare the vital events collected in the study with the events registered in the official vital records in the City of New York Department of Health. The Health Code requires that every pregnancy termination shall be registered, irrespective of the duration of pregnancy. Therefore, each event which was identified in the study should have been registered as either a live birth or a fetal death.

All official live birth and fetal death records for the 2,622 events which occurred in the five selected hospitals during the study period were linked to the study records. The results of the linking operation are shown in the following table:

Vital event by WHO definition for study records	Vital records			
	Live birth	Fetal death	Death in first week	No vital record
Live birth (Some vital sign)	2,561	4	-	-
Fetal death (No vital sign)	-	57	-	[1]1
No record	[1]3	[1]3	-	-
Total deaths in first week identified from all sources	-	-	36	4

[1] Excluded because a vital record was not filed or because a study form was not filed on time or was incomplete.

In all, 2,629 cases were identified by either mechanism, and of these, seven were excluded from the study. One case with no vital sign present had both a fetal death and live birth record filed for the same event, and the live birth record was not used in the study based on the information on the study form. In four cases where the study form indicated that a sign of life was present, fetal death rather than live birth records were prepared by the hospital and filed with the Department of Health. Significant characteristics of these four cases were the following:

Item	Case I	Case II	Case III	Case IV
Hospital	A	A	C	D
Type of hospital	Municipal	Municipal	Municipal	Voluntary
Birth weight (grams)	Unknown	312	624	1700
Gestation (completed weeks)	36	29	27	35
Malformation	Yes: type unspecified	None	None	Anencephaly
Age at death (min.)	1	Unknown	10	5
Type of delivery	Cesarean section	Spontaneous Breech	Spontaneous Breech	Cesarean section
Vital signs	Pulse Heartbeat	Pulse	Heartbeat	All 4 signs

Three of the four infants were known to be of low birth weight (2,500 grams or less); all four infants were preterm (less than 37 completed weeks of gestation); all had other than a normal delivery; and three of the four infants died within 10 minutes of birth. One fetus was described as being congenitally malformed of unspecified type and another as being anencephalic. The irregularities in registration for these four infants are no doubt associated with the problems in the delivery rooms which accompanied these "complicated" cases.

Overall, the 2,565 live births identified in the study were all registered although four were erroneously registered as fetal deaths, representing an underregistration of 0.2 percent of live births. This deficiency is similar in magnitude to that shown in other studies.[8,10,12] The statistical effect of the failure to register these four events as early neonatal deaths is more serious. Since the study identified 40 deaths in the first week of life, the understatement of four cases represents an understatement of 10 percent of the mortality in the first week of life.

During the course of the study, 57 fetal deaths were identified based on the WHO definitions, but 61 fetal death records were filed. Four of the recorded fetal deaths were determined to be live births on the basis of the observer's record, and therefore each should have had a live birth and a death record on file instead of a fetal death record. The overregistration which was found for this group of fetal deaths is not an estimate of the degree of completeness of all fetal death registration in the City of New York. The Health Code requires the registration of all pregnancy terminations irrespective of the period of gestation, but most early fetal deaths are not delivered in delivery rooms and consequently were not included in this study.

The study demonstrated a relatively small degree of error in the registration of live births in the five hospitals. The misregistration of four live births as fetal deaths was documented as being associated with early termination of pregnancy, death in the first 10 minutes of life, and with complicated deliveries. Thus despite the fact that the study observers and the study staff were not entirely independent, one source of inaccurate vital registration and vital statistics was detected—i.e., the failure to register some very early neonatal deaths as live births and deaths, and their misregistration as fetal deaths.

DISCUSSION

The conduct of this study has demonstrated the feasibility of conducting studies of vital signs at birth in the delivery rooms of hospitals. The study site, New York, has a history of collaborative obstetrical studies, and close cooperation has developed between the Department of Health and the obstetrical departments of hospitals. Through the assistance of the Department's obstetrical consultants, the cooperation of the heads of the obstetrical departments of the five hospitals was secured. The presence of observers in the delivery room was accepted by the hospitals and seemed to cause no problems. The fact that they were selected by the heads of the obstetrical departments from residents or interns of the same hospitals probably facilitated the conduct of the study.

The matter of *independent* observations of each of the vital signs was not completely solved. Observers were from the same hospitals in which the study was conducted and may have been influenced by common training. After the fact, it can only be said that the information recorded on the study forms represented a synthesis of the observations of the observer and some unknown input from the accoucheur through the observer. In future studies which may be conducted in other locales, it may be possible to establish a team of observers to rotate among a group of study hospitals to overcome some of the reservations which were experienced.

The study form was fairly simple and appeared to cause no problems. The routing of the forms to the Department of Health at weekly intervals helped to keep the hospitals aware that the forms had to be transmitted promptly.

With regard to vital signs, it was found that heartbeat in the first 2 minutes of life could serve as the only criterion of live birth virtually as well as the WHO definition. Only one of the 2,565 live births would have been missed if heartbeat were the only vital sign considered (table 9). Pulsation of the umbilical cord was poorest in this respect: 81 of the 2,565 live births would have been missed. In general, when there is a strong heartbeat in the newborn

infant, a pulsation of the umbilical cord can be detected. However, when the heartbeat is weak, pulsation of the cord may be difficult to detect. Pulsation of the cord was not recorded as present or absent for 11 cases and was either overlooked by the observer or was not recorded due to an oversight. These 11 instances occurred in two of the five hospitals (table 3).

Since the WHO definition is intended for use under a great range of circumstances, it would not be desirable to extrapolate from the present experience in a highly structured hospital setting to effect a change in definition for use in a worldwide range of nonhospital settings by persons with a wide range of medical experience. In this study, heartbeat was detected by highly trained medical personnel under favorable circumstances including the use of palpation and auscultation, but these conditions may not readily be duplicated on a worldwide basis. For international comparisons, it seems quite evident that the current WHO definitions of live birth and fetal death are superior to any based on single vital signs. Of the 2,565 infants classified as live births by the WHO definitions, 67 failed to demonstrate any respiratory effort in the first 2 minutes of life (table 9). Of these, 18 died before the end of the first week, and 49 survived the first week of life. Thus respiratory effort in the first 2 minutes of life is highly unsatisfactory as an only indicator of live birth.

After the fact, it is easy to say that even though these 67 infants did not breathe within 2 minutes after birth, their demise later in the first week after birth or their survival past that point is evidence that they were born alive. Such reasoning implies either that other signs of life must have been used as a criterion of life at birth, or that observations at some unspecified point in time following birth played a part in determining whether an infant was alive at time of birth. Although such practices would provide rational solutions to questionable cases, they demonstrate that breathing alone is not a satisfactory criterion for establishing live birth and reinforce the need for other signs of life to determine whether an infant is alive *at time of birth.*

The results of this study demonstrate the wisdom of including a number of possible signs of life in the definition of live birth. The WHO definition contains the words ". . . breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached;. . . ."[4] The structure of the definition indicates that these four signs are illustrative and not necessarily exhaustive.

The problem of defining "life" currently faces the medical and legal professions and is still subject to change. What is life? At what point in time does an individual die? The questions are presently of particular importance with regard to organ transplants. In that connection, it has been suggested that the point at which the brain ceases to emit impulses is the true time of death. Such new concepts may play a role in defining "life" in the future, and they may impinge on the WHO definition of "live birth" as well. However, their incorporation into a definition of live birth for worldwide usage may not be practical for many years to come.

The alternative definitions of live birth which can be constructed using observations of one or more of the four signs of life during the first 2 minutes after birth, and without regard to whether the signs appeared later, resulted in marked differences in vital rates. The smallest differences from rates based on the WHO definitions were found for those combinations of signs which included heartbeat.

These results clearly demonstrate that statistical manipulation of data, as in the perinatal rate, cannot overcome the problems caused by conceptual differences in definitions which almost inevitably (1) allow events subsequent to the time of the birth to influence its classification as a fetal death or live birth, and (2) foster the failure to register a live birth and infant death when the early postpartum course is other than survival.

One purpose of this study was to examine the statistical effect of the possible alternate combinations of signs of live birth on vital statistics. From a statistical view, the matter of definitions would not matter much if the errors were of such a magnitude that the rates would be affected little or, perhaps, not at all. The comparison presented in tables 10 and 11 is carried out within the framework of the dichotomy between live birth and fetal death as

defined by the World Health Organization. In this report, the data can be arranged to segregate this class, and its magnitude in regard to vital statistics rates can be examined.

The effect of acceptance of any of the four signs of life as an indication of live birth, in contrast with most of the other combinations which are shown, is to include more of the births as liveborn infants and fewer as fetal deaths (table 8). This affects not only the number of fetal deaths in the numerator of a rate and the number of live births in the denominator but the number of deaths in the first week of life as well. Thus one effect of the application of the WHO definition would be to lower the fetal death ratio and to increase the mortality rate in the first week of life (tables 10 and 11). The basic reason for the unsatisfactory nature of the rates other than those involving heartbeat is that a number of events failed to manifest one of the specified signs of life in the first 2 minutes of life, but were alive at the end of the first week of life:

Vital sign	Specified sign absent in first 2 minutes of life	Infant alive at end of first week
Respiratory effort	67	49
Pulsation of umbilical cord	81	74
Movement of voluntary muscles	71	55
Heartbeat	1	-

One of the fundamentals in constructing fetal death ratios and mortality rates for the first week of life is the absolute dichotomy: if a vital event is not a live birth, it is a fetal death. To overcome problems caused by this stipulation, it has been widely suggested that perinatal mortality rates would be preferable to fetal death rates and neonatal mortality rates. For the present study, perinatal deaths were obtained by summing all fetal deaths with gestation periods of 28 completed weeks or more and early neonatal deaths in the first week of life.

Perinatal mortality ratios have been particularly advocated for use in international comparisons, not only to avoid the problems of differentiating between live birth and fetal death for a specific event, but because it was thought that they would also reduce some of the problems associated with differing practices and education of accoucheurs in various countries. The present study does not address itself directly to international comparisons, but examines the data for New York City to determine to what degree the perinatal rates solve the problem of wide variation which was noted in the fetal death ratios and mortality rates in the first week of life (table 10).

The data in table 11 address themselves to this point. In this table, fetal deaths are limited to those with gestation periods of 28 completed weeks or more, as is the custom in other countries. The range of the rates based on the several definitions of live birth and fetal death and computed as shown in Appendix II, and the ratios of the highest to the lowest rates are as follows:

Rate (ratio)	Range	Difference	Ratio of highest to lowest rate (ratio)
Fetal death rate	[1]11.2-41.1	29.9	3.67
Fetal death ratio	[1]11.3-42.9	31.6	3.80
Mortality rate in first week of life	8.8-[1]15.6	6.8	1.77
Perinatal mortality rate	[1]26.6-53.9	27.3	2.03
Perinatal mortality ratio	[1]26.9-56.2	29.3	2.09

[1] Rates based on WHO definitions of live birth, fetal death.

The arithmetic differences between the maximum and minimum rates are only slightly lower for perinatal than for fetal mortality. However, the ratios between the highest and lowest rates for perinatal deaths are markedly lower than for fetal deaths. Moreover, the ratios for perinatal rates and ratios are closer to the ratio for first-week mortality than the ratios for fetal mortality. Thus the use of perinatal mortality rates or ratios helps to reduce the range of rates and to offset the differences in one direction for fetal death rates (ratios) and in the other direction for the first-week mortality rates.

Yet, despite the achievements due to recombination of the basic data, the importance of the

basic definitions and their proper application at time of birth remains. The data which have been presented demonstrate that the presence of one or more vital signs *at time of birth* is a better definition of live birth than older definitions which relied on observing only one sign of life—i.e., respiratory effort. If applied properly, the WHO definitions of live birth and fetal death tend to promote more uniform statistics than any of the other definitions which were considered here.

The uniform application of the definitions of live birth continue to play an important part in quantitative measures of pregnancy loss. The definitions of live birth and fetal death must be applied consistently by persons responsible for providing the information for vital records (physicians, nurses) as well as by those who actually complete the documents (medical records librarians, and other record room personnel). In the hurried affairs of physicians' daily activities and the busy routines of hospital record rooms, basic matters such as definitions of vital events can easily be overlooked. Therefore, it is all the more important that these individuals be aware that their practices have direct bearing on the resulting statistical information. The completion of a single fetal death record in place of a live birth record for an infant who lives only a few minutes may appear unimportant. But wide-scale practices such as these, if they exist, would adversely affect the statistical end product to a significant degree.

CONCLUSION

The present study of vital signs present at birth was undertaken with two purposes in mind. One was to determine the feasibility of conducting studies of evidence of life at birth in an actual working situation in hospital delivery rooms. Although the study was largely successful in this regard, certain difficulties were encountered and have been described. The study was conducted in what was considered one of the most desirable settings in the country: within close range of a health department already actively engaged in the registration of all products of conception. The close relationships existing between the City of New York Department of Health and the obstetrical groups in the hospitals proved to be a distinct advantage.

That such studies are needed is evident. The relative scarcity of definitive information on vital signs present at birth and its effect on vital registration and vital statistics have resulted in confusion and indecision. Factual information is needed to form the basis of intelligent discussion.

The study should be reproduced in other settings, thus adding to the local information available to vital statisticians and registrars regarding their own systems. The studies do not require great expenditures for laboratory work or mechanical equipment—the greatest part of the cost is for observer time. The amount of unoccupied time of the observers adds to the cost. Therefore, hospitals of sufficient size should be chosen to minimize the added cost due to possible unproductive time of observers when too few births occur in a given hospital.

The second purpose of the present study was to determine the quantitative effect of varying combinations of vital signs which may be used to define live birth. The study documented the vital signs which were observed at birth and demonstrated the weakness of relying only on respiratory effort in the first 2 minutes of life as a criterion for defining live birth. Pulsation of the umbilical cord and movement of voluntary muscles were also found to be less than ideal. Heartbeat as detected by palpation or auscultation was most often present, having been absent in the first 2 minutes of life for only one of 2,565 live births. Because this sign was present in every instance but one, mortality rates based on data using this sign alone yielded virtually the same results as the WHO definition which includes any of the four vital signs. If heartbeat is omitted, the use of other signs to define a live birth and the resulting mortality rates were found to be less satisfactory. The use of perinatal rates ameliorated, but did not overcome, the problems incurred by definitions of live birth based on different signs or combinations of vital signs.

The study emphasizes the importance of basic information in vital registration and vital statistics. Its relevance extends beyond internal hospital procedures to problems of registration practices and the comparability of vital statistics. Not only are local, State, and national statistics affected by these basic definitional considerations, but international statistical comparisons are also influenced.

In all areas of statistical investigation, the quality of the data are dependent on logical and specific definitions which are uniformly applied to the observations under consideration. The statistics are no better than the basic data, which in turn can be no better than the observations and their measurement. Demographic and epidemiologic studies of infant mortality will continue to depend heavily on such elementary considerations. In fact, the lower the rates, the more important it is to control the errors of measurement including those which are attributable to definitions. If uncontrolled, such errors may exceed real differences and obliterate or exaggerate statistical differences.

With infant and perinatal mortality rates at their present levels in this country, it is becoming increasingly important that errors of measurement be kept to a minimum. To this end, the present study contributes to the understanding of vital signs at birth, definitions of live birth and fetal death, and the possible relation of these matters to the level of commonly used vital statistics rates.

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APPENDIX I

RECORDING FORM

DIRECT OBSERVATION OF DELIVERIES

1. CHILD'S NAME_____ (Last) 2. CHILD'S CHART NO._____

3. MOTHER'S NAME_____ (Last) 4. MOTHER'S CHART NO._____ (First)

5. DATE OF DELIVERY_____ (Month Day) 6. TIME OF DELIVERY_____ 7. SEX OF CHILD____

8. Type of Delivery	9. Presentation	10. Delivered by	11. Plurality
[ ] Spontaneous	[ ] Vertex	[ ] Attending	[ ] Single birth
[ ] Forceps	[ ] Breech	[ ] Resident	If not single birth specify whether
[ ] Cesarean	[ ] Transverse	[ ] Intern	[ ] 1st [ ] Twins
[ ] Other, specify	[ ] Other, specify	[ ] Medical student	[ ] 2nd of [ ] Triplets
		[ ] Nurse-Midwife	[ ] 3rd
		[ ] Student Nurse-midwife	

12. Observer_____ [ ] Other, specify

DELIVERY ROOM OBSERVATIONS

Observe neonate for presence or absence of vital signs within 120 seconds of the delivery of its entire body from the body of its mother. (if observation of any of the vital signs is not made explain below)

Vital Signs	(circle one on each line)	
13. Respiratory Effort.....	absent	present
14. Pulsation of Umbilical Cord.....	absent	present
15. Movement of Voluntary Muscles.....	absent	present
16. Heart Beat.....	absent	present

17. If live birth did infant die before leaving delivery room? Yes_____ No_____

18. If answer to 17 is Yes, give age at death_____Hours_____Mins.

COMMENTS

ELB-1

APPENDIX II

COMPUTATION OF RATES

(All rates are expressed per 1,000)

Rate	Numerator	Denominator
FETAL DEATH RATE		
Intermediate and late fetal deaths	Fetal deaths with gestation periods of 20 completed weeks or more	Live births, and fetal deaths with gestation periods of 20 completed weeks or more
Late fetal deaths	Fetal deaths with gestation periods of 28 completed weeks or more	Live births, and fetal deaths with gestation periods of 28 completed weeks or more
FETAL DEATH RATIO		
Intermediate and late fetal deaths	Fetal deaths with gestation periods of 20 completed weeks or more	Live births
Late fetal deaths	Fetal deaths with gestation periods of 28 completed weeks or more	Live births
INFANT MORTALITY RATE	Deaths in the first year of life	Live births
NEONATAL MORTALITY RATE	Deaths in the first four weeks of life	Live births
PERINATAL MORTALITY RATE[1]	Fetal deaths with gestation periods of 28 completed weeks or more, and deaths in the first week of life	Live births, and fetal deaths with gestation periods of 28 completed weeks or more
PERINATAL MORTALITY RATIO[1]	Fetal deaths with gestation periods of 28 completed weeks or more, and deaths in the first week of life	Live births

[1]Perinatal rates based on several combinations of gestation periods and age at death are found in the literature. These definitions refer to the data included in this report.

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