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Use of Active Surveillance Methodologies to Examine Over-reporting of Stillbirths on Fetal Death Certificates

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Abstract

BACKGROUND—Data from Iowa fetal death certificates (FDCs) suggest that reportable stillbirths (unintended fetal deaths ≥20 weeks gestation and/or weighing ≥350 grams) occur in about 1 in 200 deliveries. In 2005, the Iowa Department of Public Health and the Iowa Registry for Congenital and Inherited Disorders (IRCID) collaborated with other state stakeholders to establish the Iowa Stillbirth Surveillance Project. The goal of this project was to use population-based, active surveillance methodologies to identify reportable stillbirths delivered by Iowa residents since January 1, 2000.

METHODS—To conduct stillbirth surveillance, the IRCID expanded its existing public health authority and electronic abstract application for birth defects surveillance. The expanded application was piloted using a random sample (n = 250 of 989) of FDCs reported from January 2000 through December 2004.

RESULTS—IRCID procedures for active case finding and medical record abstraction verified 192 (76.8%) as reportable stillbirths. Stillbirths not verified as reportable were due to findings of elective terminations (n = 30), live births (n = 3), induced deliveries (n = 2), and FDC entries for gestational age and/or delivery weight that were either inaccurately recorded (n = 13) or accurately recorded but did not meet Iowa FDC reporting criteria (n = 9); medical records for one FDC were unavailable. Infant malformations were more common among unverified stillbirths, whereas the cause of death due to maternal-related conditions was higher among verified stillbirths.

CONCLUSIONS—These results suggest that over-reporting limits the use of FDCs as a primary ascertainment source for stillbirth surveillance in Iowa. Continued expansion of the IRCID active surveillance methodologies to monitor stillbirths in Iowa is recommended.

Keywords

fetal death; fetal death certificates; population-based; stillbirth; surveillance

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INTRODUCTION

Fetal losses that occur before 20 weeks gestation are referred to as spontaneous abortions or miscarriages and account for >90% of all fetal loss (Martin and Hoyert, 2002), whereas those that occur at or after 20 weeks gestation are commonly referred to as stillbirths. From 1970 through 1998, the United States stillbirth rate fell by more than 50% but, in the last decade, the decline has slowed and, at times, halted (Martin and Hoyert, 2002; MacDorman and Kirmeyer, 2009a; MacDorman and Kirmeyer, 2009b). Recent estimates suggest that nearly 6 of every 1000 United States births is a stillbirth resulting in an annual total of approximately 25,000; more than one half of these stillbirths occur at 20 to 27 weeks of gestation (MacDorman et al., 2007; MacDorman and Kirmeyer, 2009a; MacDorman and Kirmeyer, 2009b). Despite the high prevalence, the underlying cause(s) of stillbirths cannot be linked to any maternal, fetal, or obstetric factor in 25 to 60% of the cases (Fretts, 2005).

In the United States, the main source of stillbirth data is the National Vital Statistics System (NVSS; Martin and Hoyert, 2002). The NVSS obtains fetal death reports from all states along with the District of Columbia, New York City, and U.S. territories. Data collection within the NVSS is guided by the Model State Vital Statistics Act and Regulations (The Model Law), which defines fetal loss as showing no signs of breath or cardiac activity after expulsion (Model State Vital Statistics Act and Regulations, 1995; Martin and Hoyert, 2002). In addition, the Model Law recommends reporting a fetal loss as a stillbirth if the fetus is over 350 grams or, if no birthweight (BW) is available, the fetus is at least 20 weeks in gestational age (GA). Finally, the Model Law recommends that medically induced pregnancy terminations should not be considered a stillbirth unless fetal death occurred at or after 20 weeks gestation but before the termination.

Although stillbirth definitions used by most states are consistent with the Model Law, each state develops its own reporting criteria and fetal death certificate (FDC), which may produce variability in reporting (Buck and Johnson, 2002; Martin and Hoyert, 2002; MacDorman and Kirmeyer, 2009b). For example, stillbirths in Iowa are defined as the unintended death of a fetus that occurred at or beyond 20 gestational weeks or that weighed at least 350 grams (Iowa Department of Health, Iowa Code, Chapter 136A, 2004 Iowa Acts, Chapter 1031 [HF 2362]). Although Iowa code also requires reporting of an elective termination to state agencies (Iowa Administrative Code section 144.29A), whether medically indicated or not, an elective termination is not included in the definition of stillbirth and should not be issued an FDC.

In addition to variability among states in stillbirth definitions, previous studies suggest that NVSS data are limited in utility as a source for national stillbirth surveillance. Specifically, such studies have focused on under-reporting of stillbirths (Harter et al., 1986; Martin and Hoyert, 2002; Fretts, 2005; MacDorman and Kirmeyer, 2009a) and completeness and quality of information recorded on FDCs (Greb et al., 1987; Martin and Hoyert, 2002; Duke et al., 2008; MacDorman and Kirmeyer, 2009a). Under-reporting of stillbirths, defined as the absence of an FDC for a reportable delivery, has ranged from 7.5% when FDCs were compared to hospital records (Harter et al., 1986) to 17.8% when FDCs were compared to those identified by a stillbirth assessment program (Greb et al., 1987). Systematic under-reporting occurs more often for stillbirths near the cutoffs used for GA and BW requirements (Greb et al., 1987; Duke et al., 2007). In particular, use of a GA cutoff as an inclusion criterion has been shown to influence under-reporting with fewer stillbirths from 20 to 27 weeks gestation reported in states having a cutoff compared to those that report stillbirths for all GAs (Martin and Hoyert, 2002; Duke et al., 2007). With regard to completeness and quality of information, studies have found significantly higher levels of missing data and poorer quality (e.g., less accurate and specific) of some reported data (e.g., cause of death and birth defects) on FDCs compared to medical records (Greb et al., 1987; Martin and Hoyert, 2002; Lydon-Rochelle et al., 2005; Duke et al., 2007; Duke et al., 2008).

To summarize, several studies have examined the use of FDCs for stillbirth surveillance; however, these studies have largely focused on under-reporting of stillbirths to vital statistics. The implications of over-reporting on the epidemiologic study of possible underlying causes of stillbirth have not received in-depth investigation despite the potential impact on studies that rely on state and national vital records databases. In 2005, the Iowa

Department of Public Health (IDPH) and the Iowa Registry for Inherited and Congenital Disorders (IRCID) established the Iowa Stillbirth Surveillance Project (ISSP), a pilot project to conduct population-based surveillance for stillbirths using IRCID active surveillance methodologies originally designed to ascertain birth defects. Specifically, hospital record abstraction procedures and applications previously developed and verified by the IRCID were used. FDC reports were compared to medical record abstracts to estimate the proportion of FDCs that met the Iowa reporting criteria for stillbirths. Next, FDC reports were described by maternal and delivery characteristics. This report adds to the existing literature by examining the implications of misclassification of stillbirths, as indicated by over-reporting, for surveillance.

MATERIALS AND METHODS

Data used for this article were obtained from the IDPH and the IRCID. Three samples were used for analysis. The first sample (n = 1033) was created by collecting the total number of FDCs submitted from January 1, 2000 through December 31, 2004 to the IDPH. The average annual number of live birth and stillbirth deliveries combined during the study period was used to designate hospitals from which FDCs were collected as small (<1 delivery/week), medium (≥1 delivery/week to 1 delivery/day), or large (>1 delivery/day). The second sample (n = 250) was a proportional random sample that represented approximately 25% of the total number of FDCs issued from the study period and abstracted using IRCID active surveillance methodology. Proportional sampling was used to control for variation in FDC reporting by hospital size; thus, the number of FDCs abstracted from each hospital group was proportional to the percent of all deliveries that occurred within that group. The third sample (n = 192) was the number of abstracted FDCs verified by medical record abstraction to have met the Iowa fetal death reporting criteria (GA of at least 20 weeks or BW of at least 350 grams). For FDCs with abstracted data, each delivery was reviewed by two obstetrician-clinical geneticists. GAs reported on FDCs and in medical records were compared and adjusted when postmortem examinations indicated a GA consistent with earlier fetal demise than recorded at delivery (i.e., missed abortion [Goldhaber, 1989]).

Maternal (age, race/ethnicity, education, previous fetal loss <20 weeks, previous fetal loss ≥20 weeks, trimester prenatal care began, and tobacco and alcohol use during pregnancy) and delivery (BW, GA, autopsy performed, and cause of death) characteristics were compared between all FDCs and abstracted FDCs and between abstracted verified and unverified stillbirths using the chi-square statistic; an alpha of 0.05 was used to determine significance for all comparisons. Exact tests and standardized adjusted residuals were used to determine significance where appropriate. For all FDCs collected, the proportion of stillbirths for which an autopsy was performed was determined as reported (yes/no/unknown) on the FDC. Cause of death, also as reported on the FDC, was determined by the International Classification of Disease, version 10 (ICD-10); an unexplained cause of death included ICD-10 codes P95 (fetal death of unspecified cause) and P969 (condition originating in the perinatal period, unspecified). All analyses were conducted using SAS version 9.2 (SAS Institute, Cary, NC).

RESULTS

Of the 1033 FDCs filed from January 1, 2000, through December 31, 2004, 44 FDCs were excluded before sampling because they were delivered in another state (n = 32) or at home (n = 12) and medical records could not be obtained. Among the remaining 989 deliveries, 843 (85.2%) occurred in a large hospital, 130 (13.1%) in a medium hospital, and 16 (1.6%) in a small hospital. Using these proportions and a sample size of 250, 213 FDCs (85.2%) were selected from large hospitals, 32 (12.8%) from medium hospitals, and 5 (2.0%) from small hospitals. Based on abstracted data, 192 (76.8%) of the 250 sampled FDCs were verified as meeting Iowa FDC reporting criteria. The remainder (n = 58) were determined to be elective terminations (n = 30), live births (n = 3), induced deliveries (n = 2), or to have had FDC entries for GA and/or delivery weight that were either inaccurately recorded (n = 13) or accurately recorded but which did not meet Iowa FDC reporting criteria (n = 9); medical records for one FDC were unavailable. Of the 13 FDCs with entries for GA and/or delivery weight inaccurately recorded, medical record abstraction showed that each FDC indicated the GA when the delivery occurred, not the time of fetal demise. In total, 48 (30 + 3 + 2 + 13) of the 58 (82.8%) FDCs that did not meet Iowa FDC reporting criteria were identified by information obtained from medical record abstraction.

Among the 989 FDCs examined, frequencies of selected maternal and delivery characteristics were compared by hospital size (Table 1). Statistically significant differences were found for maternal age at delivery (chi-square [df = 4; n = 984] = 12.426; $p = 0.014$), GA (chi-square [df = 4; n = 984] = 29.339, exact $p < 0.001$), autopsy performed (chi-square [df = 4; n = 969] = 6.217; $p = 0.045$), and cause of death due to ‘complications of placenta or cord’ (chi-square [df = 2; n = 989] = 16.087; $p < 0.001$) or ‘chromosomal abnormalities’ (chi-square [df = 2; n = 989] = 6.970; $p = 0.031$). Specifically, mothers who delivered in large hospitals were more likely and mothers from medium hospitals were less likely to be between 21 and 30 years of age. Infants born in large hospitals were more likely to be early GA (20–27 weeks) and less likely to be below 20 weeks or late GA (≥28 weeks). In contrast, infants born in medium hospitals were less likely to be early GA and more likely to be below 20 weeks or late GA; infants born in small hospitals were less likely to be early GA and more likely to be late GA. Finally, infants born in medium and small hospitals were more likely and infants born in large hospitals were less likely to have ‘complications of placental cord’ as cause of death; infants from medium hospitals were less likely to have ‘chromosomal abnormalities’.

Further examination of hospital characteristics recorded on the FDCs (e.g., hospital county and mother’s county of residence) showed that elective terminations predominantly occurred (77.0%) at a single large hospital and that most often the mother’s county of residence differed from the hospital county (83.0%; data not shown). No discernible geographical pattern was found by hospital size or location for unverified stillbirths that were due to discrepancies in GA or BW. Despite the fact that the majority of births occurred in large hospitals, only 22.0% of all hospitals in Iowa were large; medium and small hospitals comprised 46.8% and 31.2%, respectively. Not surprisingly, the size of the hospital was associated with the demographics of the surrounding counties with large hospitals located in urban municipalities, medium hospitals in small to large rural communities, and small hospitals in isolated rural communities.

Few statistically significant differences were found for comparisons between the total FDC sample (n = 739) and those FDCs selected for abstraction (n = 250). Mothers with FDCs not selected for abstraction were more educated, whereas mothers in the abstracted sample were less educated (chi-square [df = 2; n = 975] = 6.759; $p = 0.034$; data not shown). Previous fetal loss (<20 weeks) was more common among mothers in the abstracted sample (chi-square [df = 1; n = 978] = 3.915; $p = 0.048$).

Although not statistically significant, the proportion of abstracted, verified stillbirths varied by hospital size (chi-square [df = 2; n = 250] = 2.879; $p = 0.237$; data not shown). All 5 (100%) stillbirths delivered in small hospitals were verified, as were 27 of 32 stillbirths (84.4%) delivered in medium hospitals and 160 of 213 (75.1%) delivered in large hospitals. The reasons for misclassification also varied by hospital size with all 30 elective terminations, three live births, and two induced deliveries reported from large hospitals. Also, 11 of 13 FDCs with entries for GA and/or delivery weight inaccurately recorded and 6 of 9 FDCs with such entries that did not meet Iowa FDC reporting criteria were reported from large hospitals.

Comparison of the 192 verified stillbirths with the 58 unverified stillbirths produced statistically significant differences for maternal age and education (chi-square [df = 2; n = 249] = 11.847; $p = 0.003$ and chi-square [df = 2; n = 249] = 6.381; $p = 0.041$, respectively); infant BW and GA (chi-square [df = 1; n = 237] = 55.253; $p < 0.001$ and chi-square [df = 1; n = 250] = 85.734; $p < 0.001$, respectively); unknown cause of death (chi-square [df = 1; n = 250] = 5.849; $p = 0.016$); and cause of death attributable to ‘maternal-related health conditions’ and ‘congenital malformations of the infant’ (chi-square [df = 1; n = 250] = 3.937; $p = 0.047$ and chi-square [df = 1; n = 250] = 23.938; $p < 0.001$, respectively; Table 2). Verified stillbirths occurred more frequently among mothers who were <26 years of age and had less than a high school education, whereas unverified stillbirths were more common among mothers aged 26 to 30 years old and less common among mothers without a high school education. As expected, BWs below 350 grams were more common among unverified stillbirths and less common among verified stillbirths. None of the unverified stillbirths were of late GA (>28 weeks); verified stillbirths were more likely to be late GA and none were below 20 weeks. Early GA stillbirths (20–27 weeks) were more common among unverified stillbirths but less common among verified stillbirths.

Autopsies were conducted at equal rates in the abstracted verified and unverified samples; however, ‘unknown cause of death’ was more common in the verified sample (Table 2). Of those with cause of death listed, ‘maternal-related health conditions’ were more common among verified stillbirths and ‘congenital malformations of the infant’ were more common among unverified stillbirths. Twenty-one of the 30 (70%) elective terminations had a congenital malformation listed on the FDC as the cause of death compared to only 15 of the 192 (7.8%) verified stillbirths. Last, medical record abstraction identified ‘underlying, contributing factors’ for 41 of the 57 (72.0%) verified stillbirths with ‘unknown cause of death’ listed on the FDC (data not shown). Of these 41 verified stillbirths, the most common contributing factors reported in medical records were ‘unspecified morphologic and functional abnormalities of placenta’ (n = 10), ‘other compression of umbilical cord’ (n = 8), and ‘congenital cytomegalovirus infection’ (n = 6).

DISCUSSION

In our abstracted sample, nearly one quarter of stillbirths that received FDCs in Iowa did not meet the state FDC reporting criteria. Of these, over 80% were not verified as reportable stillbirths due to inaccurate information reported on the FDC (e.g., elective terminations, inaccurate GA, and/or BW). The remainder of the unverified stillbirths was largely due to failure to meet Iowa stillbirth reporting criteria (GA ≥20 weeks and/or BW ≥350 grams) despite accurately reported FDC GA and BW. Differences by hospital size were found for rates of verification and underlying reasons for misclassification. Large hospitals had the highest percentage of unverified stillbirths (24.9%) with the majority requiring additional information from medical records to identify misclassification. Medium hospitals had a small percentage of unverified stillbirths (15.6%); misclassification using correct FDC information was the main reason for exclusion. All stillbirths from small hospitals were verified, although the number was very small.

Abstracted, verified stillbirths showed significant differences in contributing factors related to the underlying cause of death compared to abstracted, unverified stillbirths. Complications that involved the placenta or umbilical cord were most common among verified stillbirths, whereas congenital malformations were more common among unverified stillbirths. This difference was largely attributed to malformations identified among the elective terminations in the unverified sample. Among verified stillbirths with ‘unknown cause of death’ listed on the FDC, additional review of medical records identified potential contributing factors in 75% of the cases. Consistent with the FDCs that reported a known cause of death, the most commonly listed contributing factors among stillbirths with unknown cause of death listed on the FDC were complications with the placenta or umbilical cord and maternal infection (e.g., cytomegalovirus) during the perinatal period.

Comparisons of these findings with previous research on stillbirth surveillance is complicated by variability in stillbirth definitions across studies, differences in sampling methods, and, most importantly, a focus on under-reporting of stillbirths. Despite these limitations, our findings are generally consistent with those studies that report excluded births. For example, Greb et al. (1987) verified 80% of referrals to the Wisconsin Stillbirth Service Program (WiSSP) as stillbirths; unverified, or excluded, stillbirths were determined to be either neonatal deaths or miscarriages. Because the WiSSP is a referral-based program, elective terminations were not identified because they would not have been sent for referral. Similarly, Duke et al. (2008) verified stillbirths for 84% of selected FDCs. Identification of missed abortions and adjustment of corresponding GA/BWs were not reported in either study.

Differences in maternal and delivery characteristics between verified and unverified stillbirths showed some similarities with those reported by studies on the epidemiology of stillbirth. Maternal characteristics of younger age and less education among verified stillbirths are similar to some studies (Stoltenberg and others, 1998; Stephansson et al., 2001; Buck and Johnson, 2002; Fretts, 2005; Wilson et al., 2008; Fretts, 2010; Rom et al., 2010), but not all (Huang et al., 2008; MacDorman and Kirmeyer, 2009b; Reddy et al., 2010). Maternal race/ethnicity did not differ between verified and unverified stillbirths; however, this may be due to the predominantly non-Hispanic white population of Iowa (Fretts, 2005; Sharma et al., 2006; Duke et al., 2007; Willinger et al., 2009; Fretts, 2010). Also inconsistent with studies on stillbirth epidemiology was the finding of no difference in prior fetal loss after 20 weeks for verified and unverified stillbirths (Buck and Johnson, 2002; Fretts, 2005; Sharma et al., 2006; Fretts, 2010). The finding of significantly higher occurrence of maternal-related conditions and elevated occurrences of complications of placenta or cord among verified stillbirths was consistent with other studies (Incerpi et al., 1998). Finally, recorded autopsies and unknown cause of death were slightly lower but consistent with previous reports (Incerpi et al., 1998; Duke et al., 2007; Measey et al., 2007).

Among our abstracted, unverified stillbirths that met Iowa FDC reporting criteria, the majority required additional medical record abstraction to identify misclassification and underlying reason for exclusion (e.g., missed spontaneous abortion, elective termination). To minimize the impact of such misclassification, reportable stillbirths for surveillance could be those that occur at 28 weeks gestation or later, which in our data would have excluded all unverified (i.e., over-reported) stillbirths. Omitting early stillbirths, however, prevents researchers and practitioners from identifying what may be a completely different set of risk factors predicting nearly one half of all reportable stillbirths that occur. Furthermore, although focusing on late stillbirths would minimize over-reporting, the likelihood of under-reporting would increase as suggested by some studies (Harter et al., 1986; Greb et al., 1987; Martin and Hoyert, 2002; MacDorman and Kirmeyer, 2009a; MacDorman and Kirmeyer, 2009b; Fretts, 2010). Further, rates of early stillbirths have not seen declines comparable to those of late stillbirths (MacDorman and Kirmeyer, 2009b), which suggests continued need to ascertain and study the etiology of early stillbirths. Recent reports from the Metropolitan Atlanta Congenital Defects Program have demonstrated that the greatest reduction in over-reporting and under-reporting of stillbirths is achieved by combining case ascertainment approaches (i.e., active surveillance methodologies with multisource case ascertainment, including FDCs; Duke et al., 2008). As such, the most effective approach to improving stillbirth surveillance could be to incorporate active case finding approaches, as demonstrated by the ISSP and other active surveillance programs (e.g., WiSSP; Greb et al., 1987), into stillbirth surveillance.

Further study into reasons why reporting inaccuracies occur could also help guide training of healthcare providers on stillbirth reporting. For example, medical record abstraction showed that the underlying contributing factor, and not elective termination, was listed as the cause of death on unverified stillbirths identified as elective terminations. Additional training could provide clarification on the definition of a reportable stillbirth under circumstances when a mother is referred for elective termination due to maternal or fetal complications. Furthermore, our analysis showed that unverified stillbirths occurred more frequently in medium to large hospitals. Active surveillance could be used to maximize resources by focusing training efforts toward those institutions or counties that demonstrate consistent inaccuracies in stillbirth reporting instead of providing statewide training.

Overall, this study examined the utility of FDCs as a primary ascertainment source for stillbirth surveillance in Iowa. One limitation of this study was the inability to account for stillbirths that did not receive an FDC, as this sample was selected to pilot abstraction of stillbirth surveillance. As a result, examination of under-reporting of stillbirths was not possible with these data. Second, the primary focus of this report was to examine the utility of FDCs for identifying the occurrence of stillbirth in Iowa; thus quality and quantity of information reported on the FDCs were not evaluated. A future goal of the ISSP is to use the expanded surveillance data to examine quality/quantity of FDC information and agreement between multiple sources. Last, although the abstracted information from medical records provided additional information on possible underlying contributions to cause of death, this information was not further classified using ICD-10 codes. A future goal of the ISSP is to use the expanded dataset to conduct systematic analyses of the agreement and improvement in specificity on cause of death between FDC and abstracted data. Despite these limitations, our results provide additional support for continued development of active surveillance methodologies to obtain comprehensive, accurate ascertainment of stillbirths, thereby facilitating research for these outcomes at the state and national levels.

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Table 1

Maternal and Delivery Characteristics by Hospital Size[a]

FDC information	Total (n = 989) n	Total (n = 989) %	Large (n = 843) n	Large (n = 843) %	Medium (n = 130) n	Medium (n = 130) %	Small (n = 16) n	Small (n = 16) %
Maternal characteristics								
Age[b]								
<26 years old	412	41.9	334	39.8	69	53.5	9	56.3
26–30 years old	274	27.8	245	29.2	24	18.6	5	31.3
>30 years old	298	30.3	260	1.2	36	27.9	2	12.5
Race/ethnicity[c]								
Non-Hispanic white	815	82.5	689	81.8	112	86.2	14	87.5
Non-Hispanic black	65	6.6	63	7.5	2	1.5	0	0.0
Hispanic	67	6.8	54	6.4	12	9.2	1	6.3
Other	41	4.2	36	4.3	4	3.1	1	6.3
Education								
<12 years	172	17.6	138	16.6	29	22.7	5	31.3
12 years	307	31.5	258	31.1	43	33.6	6	37.5
>12 years	496	50.9	435	52.3	56	43.8	5	31.3
Trimester prenatal care began[c]								
No prenatal care	23	2.6	19	2.5	3	2.8	1	7.7
2nd–3rd trimester	111	12.8	94	12.6	15	13.8	2	15.4
1st trimester	736	84.6	635	84.9	91	83.5	10	76.9
Tobacco use								
Yes	251	25.7	211	25.3	34	26.4	6	37.5
No	727	74.3	622	74.7	95	73.6	10	62.5
Alcohol use[c]								
Yes	34	3.5	30	3.6	3	2.3	1	6.3
No	943	96.5	803	96.4	125	97.7	15	93.8
Previous fetal loss <20 weeks								
Yes	312	31.9	273	32.6	35	28.0	4	25.0

FDC information	Total (n = 989)		Large (n = 843)		Medium (n = 130)		Small (n = 16)	
	n	%	n	%	n	%	n	%
No	666	68.1	564	67.4	90	72.0	12	75.0
Previous fetal loss ≥20 weeks								
Yes	83	8.9	71	8.8	11	9.0	1	6.7
No	864	91.2	739	91.2	111	91.0	14	93.3
Delivery characteristics								
Birth weight (BW, grams)								
<350	199	20.9	180	22.2	18	14.6	1	6.3
≥350	752	79.1	632	77.8	105	85.4	15	93.8
Gestational age (GA, weeks)[b,c]								
<20	28	2.9	19	2.3	8	6.3	1	6.3
20–27	487	49.5	441	52.5	45	35.2	1	6.3
≥28	469	47.7	380	45.2	75	58.6	14	87.5
Autopsy performed[b]								
Yes	320	33.0	260	31.6	88	42.6	5	31.3
No	649	67.0	564	68.4	74	57.4	11	68.8
Unknown cause of death								
Yes	264	26.7	229	27.2	33	25.4	2	12.5
No	725	73.3	614	72.8	97	74.6	14	87.5
Cause of death listed on FDC[d]								
Complications of placental cord[b]	300	30.3	236	28.0	55	42.3	9	56.3
Maternal-related health conditions	121	12.2	105	12.5	15	11.5	1	6.3
Low birth weight	50	5.1	45	5.3	4	3.1	1	6.3
Chromosomal abnormalities[b]	45	4.6	42	5.0	1	0.8	2	12.5
Congenital malformations of infant	109	11.0	97	11.5	11	8.5	1	6.3
Infant respiratory complications[c]	26	2.6	25	3.0	1	0.8	0	0.0
Other causes	64	6.5	54	6.4	10	7.7	0	0.0

[a]Numbers vary because of incomplete or missing data.

[b]$p < 0.05$.

[c] Exact test used to estimate *p* value.

[d] ICD-10 codes for FDCs listing known cause of death: complications of placental cord (P02.0–P02.9); maternal-related health conditions (diabetes [P70.0–70.1]; pregnancy-related [P01.0–P01.3, P01.5–P01.8]; hypertension [P00.0]); low birth weight (P05.9, P07.0, P07.1, P07.3); chromosomal abnormalities (Q90.9, Q91.3, Q91.7, Q92.7, Q92.8, Q92.9, Q96.9, Q99.8, Q99.9); congenital malformations of infant (nervous system [Q00.0, Q01.9, Q03.9, Q04.3, Q04.9, Q05.9, Q07.9]; other [Q33.6, Q37.9, Q45.8, Q60.2, Q61.3, Q62.0, Q64.2, Q73.0, Q74.8, Q74.9, Q75.0, Q78.9, Q79.0, Q79.2, Q79.3, Q79.8, Q89.7, Q898, Q89.9]; heart [Q21.3, Q22.5, Q23.4, Q24.8, Q24.9, Q27.0]); infant respiratory complications (P20.1, P20.9, P21.9, P24.0, P28.0, P28.5, P29.1, P29.8); other causes (D18.1, E34.3, E75.2, O69.2, P03.0, P03.5, P03.6, P03.8, P04.2, P04.9, P35.1, P36.0, P36.9, P39.8, P39.9, P50.4, P55.8, P55.9, P61.4, P61.8, P83.2, P00.1–P00.3, P00.5, P00.7, P00.8).

FDC, fetal death certificate; ICD, International Classification of Diseases.

Table 2

Maternal and Delivery Characteristics for Verified and Unverified Stillbirths[a]

	Abstracted (n = 250)		Unverified stillbirths (n = 58)		Verified stillbirths (n = 192)	
Characteristics	n	%	n	%	n	%
Maternal						
Age[b]						
<26 years old	110	44.2	15	25.9	95	49.7
26–30 years old	74	29.7	26	44.8	48	25.1
>30 years old	65	26.1	17	29.3	48	25.1
Race/ethnicity[c]						
Non-Hispanic white	210	84.0	52	89.7	158	82.3
Non-Hispanic black	16	6.4	1	1.7	15	7.8
Hispanic	15	6.0	2	3.4	13	6.8
Other	9	3.6	3	5.2	6	3.1
Education[b]						
<12 years	56	22.7	6	10.5	50	26.3
12 years	79	32.0	20	35.1	59	31.1
>12 years	112	45.3	31	54.4	81	42.6
Trimester prenatal care began[c]						
No prenatal care	5	2.2	1	1.8	4	2.3
2nd–3rd trimester	27	11.7	4	7.3	23	13.1
1st trimester	199	86.2	50	90.9	149	84.7
Maternal tobacco use						
Yes	75	30.4	13	23.2	62	32.5
No	172	69.6	43	76.8	129	67.5
Maternal alcohol use[c]						
Yes	8	3.2	3	5.4	5	2.6
No	239	96.8	53	94.6	186	97.4
Previous fetal loss <20 weeks						
Yes	92	36.9	24	42.1	68	35.4

Characteristics	Abstracted (n = 250)		Unverified stillbirths (n = 58)		Verified stillbirths (n = 192)	
	n	%	n	%	n	%
No	157	63.1	33	57.9	124	64.6
Previous fetal loss ≥20 weeks						
Yes	23	9.5	3	5.3	20	10.8
No	220	90.5	54	94.7	166	89.2
Delivery						
Birth weight (BW, grams)[b]						
<350	53	22.4	31	60.8	22	11.8
≥350	184	77.6	20	39.2	164	88.2
Gestational age (GA, weeks)[b]						
<20	10	4.0	10	17.2	0	0.0
20–27	123	49.2	48	82.8	75	39.1
≥28	117	46.8	0	0.0	117	60.9
Autopsy performed						
Yes	85	35.0	15	26.3	70	37.6
No	158	65.0	42	73.7	116	62.4
Unknown cause of death[b]						
Yes	65	26.0	8	13.8	57	29.7
No	185	74.0	50	86.2	135	70.3
Cause of death listed on FDC[d]						
Complications of placental cord	79	31.6	13	22.4	66	34.4
Maternal-related health conditions[b]	32	12.8	3	5.2	29	15.1
Low birth weight[c]	15	6.0	3	5.2	12	6.3
Chromosomal abnormalities[c]	9	3.6	4	6.9	5	2.6
Congenital malformations of infant[b]	26	10.4	16	27.6	10	5.2
Infant respiratory complications[c]	6	2.4	2	3.5	4	2.1
Other causes[c]	15	6.0	7	12.1	8	4.2

[a]Numbers vary because of incomplete or missing data.

[b]$p < 0.05$.

[c]Exact test used to calculate *p* value.

[d]ICD-10 codes for FDCs listing known cause of death: complications of placental cord (P02.0–P02.9); maternal-related health conditions (diabetes [P70.0–70.1]; pregnancy-related [P01.0–P01.3, P01.5–P01.8]; hypertension [P00.0]); low birth weight (P05.9, P07.0, P07.1, P07.3); chromosomal abnormalities (Q90.9, Q91.3, Q91.7, Q92.7, Q92.8, Q92.9, Q96.9, Q99.8, Q99.9); congenital malformations of infant (nervous system [Q00.0, Q01.9, Q03.9, Q04.3, Q04.9, Q05.9, Q07.9]; other [Q33.6, Q37.9, Q45.8, Q60.2, Q61.3, Q62.0, Q64.2, Q73.0, Q74.8, Q74.9, Q75.0, Q78.9, Q79.0, Q79.2, Q79.3, Q79.8, Q89.7, Q898, Q89.9]; heart [Q21.3, Q22.5, Q23.4, Q24.8, Q24.9, Q27.0]); infant respiratory complications (P20.1, P20.9, P21.9, P24.0, P28.0, P28.5, P29.1, P29.8); other causes [D18.1, E34.3, E75.2, O69.2, P03.0, P03.5, P03.6, P03.8, P04.2, P04.9, P35.1, P36.0, P36.9, P39.8, P39.9, P50.4, P55.8, P55.9, P61.4, P61.8, P83.2, P00.1–P00.3, P00.5, P00.7, P00.8).

FDC, fetal death certificate; ICD, International Classification of Diseases.