Impact of Fetal Death Reporting Requirements on Early Neonatal and Fetal Mortality Rates and Racial Disparities

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ABSTRACT

Objective. Racial disparities in infant and neonatal mortality vary substantially across the U.S. with some states experiencing wider disparities than others. Many factors are thought to contribute to these disparities, but state differences in fetal death reporting have received little attention. We examined whether such reporting requirements may explain national variation in neonatal and fetal mortality rates and racial disparities.

Methods. We used data on non-Hispanic white and non-Hispanic black infants from the U.S. 2000–2002 linked birth/infant death and fetal death records to determine the degree to which state fetal death reporting requirements explain national variation in neonatal and fetal mortality rates and racial disparities. States were grouped depending upon whether they based the lower limit for fetal death reporting on birthweight alone, gestational age alone, both birthweight and gestational age, or required reporting of all fetal deaths. Traditional methods and the fetuses-at-risk approach were used to calculate mortality rates, 95% confidence intervals, and relative and absolute racial disparity measures in these four groups.

Results. States with birthweight-alone fetal death thresholds substantially underreported fetal deaths at lower gestations and slightly overreported neonatal deaths at older gestations. This finding was reflected by these states having the highest neonatal mortality rates and disparities, but the lowest fetal mortality rates and disparities.

Conclusions. Using birthweight alone as a reporting threshold may promote some shift of fetal deaths to newborn deaths, contributing to racial disparities in neonatal mortality. The adoption of a uniform national threshold for reporting fetal deaths could reduce systematic differences in live birth and fetal death reporting.

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Racial disparities in infant and neonatal mortality are serious public health problems in the United States, with mortality rates among black infants averaging twice as high as their white counterparts. In addition, racial disparities vary substantially across the U.S., with some states experiencing wider disparities than others.[1–3] Factors reported to be associated with geographic variation in mortality and disparities include state-level differences in maternal risk characteristics, low birthweights, and obstacles to accessing care.[2] However, it is possible that some geographic variation in mortality and disparity could stem from differences in the way fetal deaths are reported, which has received little attention in relation to infant and neonatal mortality rates[3,4] and racial disparities.[5]

Although all states require the reporting of a live birth regardless of gestational length or birthweight, there is considerable variation in fetal death reporting criteria. The most recent revision of the Model State Vital Statistics Act and Regulations recommends the following definition of a fetal death: ". . . death prior to the complete expulsion or extraction from its mother of a product of human conception . . . after such expulsion or extraction the fetus does not breathe or show any evidence of life . . . each fetal death of 350 grams or more, or if weight is unknown, of 20 completed weeks of gestation or more . . . shall be reported . . . ."[6] Because the Act only recommends this definition, nationwide variation occurs in the criteria states use for setting the lower threshold for reporting fetal deaths, which are generally based on some combination of birthweight and gestational age. The combination of state variation in what is reportable as well as imprecision in recognizing brief or faint signs of life could lead to systematic misclassification of fetal deaths or live births and subsequent neonatal deaths as well as under- or overestimation of state fetal and neonatal mortality rates. Furthermore, because black infants are overrepresented among both extremes of low birthweight and gestational age in the U.S., different reporting criteria for fetal deaths could also affect racial disparities in neonatal and fetal mortality.

Previous studies in this area have mainly focused on differential reporting of live births, not fetal deaths, with most emphasis placed on variability in reporting extremely low birthweight live births.[4,7] One of the few studies to examine reporting of fetal deaths concluded that there was little effect of fetal death reporting on racial disparities in the U.S.; however, the study did not examine regional differences in fetal death reporting.[5] Another recent analysis that examined fetal deaths only examined deaths among fetuses weighing <500 grams, which does not include the full population of affected infants.[8] Finally, none of these studies examined mortality rates using both traditional methods and the fetuses-at-risk approach, which could lead to different conclusions.[9] Fetal death reporting can affect fetal death rates in two ways—through complete omission of fetal deaths from any record or by shifting fetal deaths into the neonatal death category. However, the neonatal death rate can only be affected by the latter.

The objective of this study was to use both traditional methods and the fetuses-at-risk approach to determine the degree to which state fetal death reporting requirements influence national variation in early neonatal and fetal mortality rates and associated black/white racial disparities. We hypothesized the following: (*1*) Due to systematic misclassification of neonatal and fetal deaths, early neonatal and fetal mortality rates and disparities will vary depending on state fetal death reporting requirements, especially at lower gestations. (*2*) Racial disparities in early neonatal and fetal mortality will also vary depending on the disparity measure used (i.e., relative vs. absolute disparity).

To our knowledge, this analysis is the first to use both traditional methods and the fetuses-at-risk approach to assess reasons for national variation in early neonatal and fetal mortality rates and racial disparities.

METHODS

Data source

We used 2000–2002 birth and linked infant death and fetal death records from the National Center for Health Statistics (NCHS) Division of Vital Statistics for this study.[10] The three consecutive years of complete birth cohorts included data in which infants born in an entire year were linked to deaths occurring within a year of their birth, regardless of calendar year. Data were coded according to uniform coding specifications, passed rigid quality control standards, and were subsequently edited and reviewed before being referred to as official U.S. birth and death statistics.[10] Fetal death statistics were based on all reports of fetal death received by NCHS for each year.

Although more recent cohort data (2003–2005) have become available since we embarked on this study, the slight changes in infant mortality that were found from 2000–2002 to 2003–2005 were not statistically significant (2000–2002 infant mortality rate [IMR] = 6.89 per 1,000 live births vs. 2003–2005 IMR=6.82 per 1,000 live births). Race-specific mortality rates have exhibited similar nonsignificant declines.[11] Thus, we determined that these small changes would not affect our conclusions.

Inclusion criteria

To focus more clearly on black-white racial differences in neonatal and fetal mortality, we excluded births and fetal deaths in which maternal race was classified as of Hispanic origin or where maternal race was not listed. The study population thus included all singleton live births and fetal deaths to non-Hispanic white and non-Hispanic black (hereafter referred to as white and black) maternal residents of the U.S. Because the U.S. standard does not recommend reporting them as fetal deaths, and because of documented variation in classification at extreme gestational ages and weights,[8] births of less than 20 weeks gestation were excluded (n=2,902 live births, 2,331 infant deaths, and 80,783 fetal deaths). Records with missing gestational age were also excluded (n=108,784 births, 2,174 infant deaths, and 7,563 fetal deaths). We chose to limit only on gestational age and not by birthweight because of the less restrictive nature of gestational age (e.g., at 20 weeks, the fifth percentile is 249 grams).

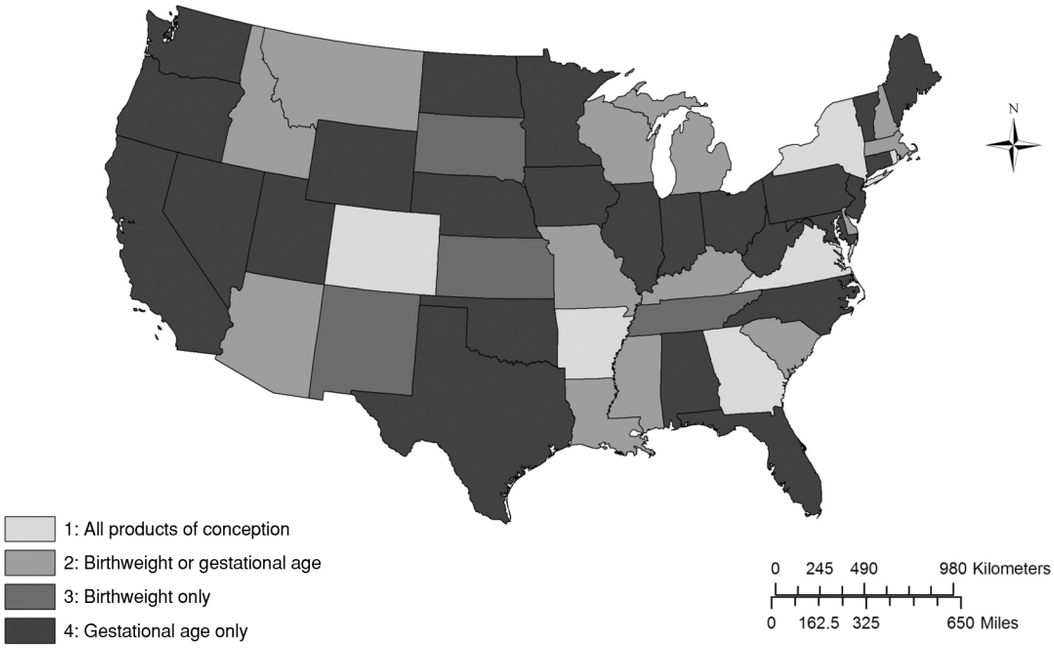
Outcome and exposure definitions

Our primary outcomes were early neonatal mortality rates (deaths occurring between one and six days of life, expressed per 1,000 live births), fetal mortality rates (expressed per 1,000 live births), and racial disparities. We selected early neonatal mortality as opposed to neonatal or infant mortality because it allowed for a more specific examination of the deaths that would be most amenable to variations in reporting laws.

Our primary exposures were state-level fetal death reporting requirements. To operationalize reporting practices, state fetal death reporting laws were initially categorized based on the latest revision of the Fetal Death Registration Requirements (1997)[6] as follows: all products of human conception (eight states), gestation of ≥20 weeks (25 states), birthweight ≥350 grams (one state), birthweight ≥350 grams or gestation of ≥20 weeks (12 states), birthweight ≥400 grams or gestation of ≥20 weeks (one state), birthweight ≥500 grams or gestation of ≥20 weeks (one state), birthweight ≥500 grams (three states), and gestation of ≥16 weeks (one state). Fetal death reporting laws were then consolidated into areas thought to capture most of the reporting differences that may occur through differences in birthweight or gestational age criteria (Figure). The four reporting areas resulting from this aggregation included states that reported fetal deaths as follows:

1. Area 1: all products of conception, regardless of birthweight or gestational age (n=1,492,477 births)

Figure. Fetal death registration areas, U.S., 1997 revision[a]



[a]Kowaleski J. State definitions and reporting requirements for live births, fetal deaths, and induced terminations of pregnancy (1997 revision). Hyattsville (MD): National Center for Health Statistics (US); 1997.

2. Area 2: birthweight criteria or gestational age criteria (n=1,804,940 births)
3. Area 3: birthweight criteria only (n=379,412 births)
4. Area 4: gestational age criteria only (n=6,085,535 births)

Analysis

We calculated mortality rates by categories of gestational age (20–22, 23–27, 28–32, 33–36, and ≥37 weeks) two ways. First, we used the traditional approach of dividing the number of deaths in a gestational age category by live births and fetal deaths occurring in the same category. Mortality rates and 95% confidence intervals (CIs) for the traditional approach were expressed per 1,000 live births. This approach is usually used when calculating infant mortality rates but does not necessarily include the most appropriate denominator for fetal mortality rates (i.e., all fetuses at risk for death). Therefore, we additionally used the fetuses-at-risk approach, which includes all fetuses still *in utero* (calculated as live births born at all later gestational ages), as well as fetal deaths in the denominator.[9] Mortality rates and 95% CIs calculated using the latter approach were expressed per 1,000 fetuses at risk. We tested for statistically significant differences between the reporting areas overall and used the reporting area with the lowest fetal mortality rate as the reference.

We calculated racial disparities in mortality rates using three methods. First, we conservatively compared 95% CIs associated with race-specific mortality rates to determine if intervals overlapped. Next, we calculated both relative and absolute measures of racial disparity, because both measures are useful in different ways depending on both the size of the rates and the magnitude of the difference between the two groups. Relative racial disparity was calculated using the disparity rate ratio (RR) (e.g., black mortality/white mortality). Absolute racial disparity was calculated using the disparity rate difference (RD) (e.g., black mortality – white mortality). All RDs were expressed either per 1,000 live births or per 1,000 fetuses at risk. In the case of no racial disparity, the RR=1.0 and the RD=0.0. Statistical analyses were conducted using SAS® version 9.2.[12]

RESULTS

Traditional methods

Table 1 shows race-specific early neonatal and fetal mortality rates, relative disparities, and absolute disparities (using traditional methods) for all U.S. births ≥20 weeks gestation by fetal death reporting area. The study population included 10,887,676 live births, 62,061 infant deaths, and 66,366 fetal deaths. The highest total early neonatal mortality rates were observed in area 3 (3.1 per 1,000 live births), while the lowest total early neonatal mortality rates were observed in area 4 (2.6 per 1,000 live births). The highest total fetal mortality rates, however, were observed in area 1 (7.6 per 1,000 live births), while the lowest total fetal mortality rates were seen in area 3 (4.1 per 1,000 live births).

Race-specific analyses indicated that early neonatal and fetal mortality rates among black infants were significantly higher than mortality rates among their white counterparts in each reporting area. RRs varied little across the four reporting areas (range: 2.2–2.6), while RDs tended to show larger differences across reporting areas (range: 2.9–7.6 per 1,000 live births), although reporting area differences in disparity measures were not statistically significant. In general, area 3, which used birthweight-only reporting for fetal deaths, tended to have higher RDs in early neonatal mortality and lower RDs in fetal mortality. Area 3 experienced RDs of 4.0 per 1,000 live births in early neonatal mortality (U.S. overall 3.2 per 1,000 live births) and 4.2 per 1,000 live births in fetal mortality (U.S. overall 6.4 per 1,000 live births).

Table 2 further assesses the influence of reporting area on early neonatal and fetal mortality rates and racial disparities (using traditional methods) by examining five gestational age categories—20–22 weeks, 23–27 weeks, 28–32 weeks, 33–36 weeks, and ≥37 weeks—that were small enough to capture the most reporting area variation. Among infants at 20–22 weeks gestation, where we expected the largest influence of reporting laws, the highest total early neonatal mortality rate was seen in area 3 (813 per 1,000 live births), while the lowest total early neonatal mortality rate was again seen in area 4 (733 per 1,000 live births). Similar to Table 1, fetal mortality rates at 20–22 weeks and 23–27 weeks gestation were significantly lower in area 3 than in all other reporting areas (232 per 1,000 live births and 146 per 1,000 live births, respectively).

The often-described survival advantage at lower gestational ages for black infants was seen in these data as well. Black infants in most gestational categories up to 37 weeks were less likely to die than their white counterparts in all reporting areas, and in the U.S. overall, with the exception of births at 20–22 weeks gestation, in area 3. This finding raises the possibility that if there is, relative to the rest of the U.S., some replacement of fetal deaths with live births in area 3 at extremely low gestational ages, this process could contribute to higher disparities in early neonatal mortality in area 3. For fetal deaths, however, the black survival advantage was noted only in the two gestational age categories

Table 1. Infant, early neonatal, and fetal mortality rates (per 1,000 live births) and racial disparities among all infants by fetal death registration area, U.S., 2000–2002

	All infants (n=10,887,676 births)				
	Mortality rates			*Racial disparities*	
Fetal death area	*Total*	*White*	*Black*	*Rate ratio*[a]	*Rate difference*[b]
Infant mortality rate (per 1,000 live births)					
United States	5.7[c]	4.7[c]	11.0[c,d]	2.4	6.3
Area 1[e]	5.8[c]	4.6[c]	10.0[c,d]	2.2	5.4
Area 2[f]	6.2[c]	4.9[c]	11.9[c,d]	2.4	7.0
Area 3[g] (Ref.)	6.7	5.6	13.2[d]	2.4	7.6
Area 4[h]	5.5[c]	4.6[c]	10.9[c,d]	2.4	6.3
Early neonatal mortality rate (per 1,000 live births)					
United States	2.7[c]	2.2[c]	5.4[c,d]	2.4	3.2
Area 1[e]	2.9	2.2	5.2[c,d]	2.3	2.9
Area 2[f]	3.0	2.3	5.9[d]	2.5	3.6
Area 3[g] (Ref.)	3.1	2.5	6.5[d]	2.6	4.0
Area 4[h]	2.6[c]	2.2[c]	5.2[c,d]	2.4	3.1
Fetal mortality rate (per 1,000 live births)					
United States	6.1[c]	5.0[c]	11.4[c,d]	2.3	6.4
Area 1[e]	7.6[c]	5.9[c]	13.4[c,d]	2.3	7.5
Area 2[f]	6.0[c]	4.9[c]	10.9[c,d]	2.2	6.0
Area 3[g] (Ref.)	4.1	3.5	7.7[d]	2.2	4.2
Area 4[h]	5.8[c]	5.0[c]	11.1[c,d]	2.2	6.1

[a]Rate ratio = black rate / white rate

[b]Rate difference = black rate – white rate

[c]Statistically significant differences between fetal death reporting areas (Area 3 = referent)

[d]Statistically significant racial differences between mortality rates (white = referent)

[e]Area 1 = all products of conception

[f]Area 2 = birthweight and gestational age criteria

[g]Area 3 = birthweight only criteria

[h]Area 4 = gestational age only criteria

Ref. = referent group

of 20–22 weeks and 23–27 weeks. Higher than that threshold, fetal deaths were significantly more common in black infants in each reporting area.

Fetuses-at-risk approach

To further explore the differences between area 3 and the rest of the U.S. in fetal death reporting, we used the fetuses-at-risk approach. Table 3 shows race-specific early neonatal and fetal mortality rates and disparities, with fetuses at risk as the denominator, among infants in the total U.S. and area 3. When fetuses at risk were used as the denominator, the early neonatal mortality rates were higher in area 3 than in the U.S. at each gestational threshold and among both races. This trend was slightly more pronounced in black births, so that, in general, early neonatal mortality rates were higher in area 3 than in the U.S. Racial disparities in fetal mortality in relation to reporting area varied by gestational age. Fetal death rates were generally lower in area 3 than in the U.S., with the exception of black fetal death rates for infants >33 weeks gestational age, which were slightly higher than the U.S.

DISCUSSION

This study was designed to determine the extent to which fetal death reporting requirements influence early neonatal and fetal mortality rates and racial disparities. Fetal death reporting requirements were hypothesized to especially influence mortality rates among extremely preterm infants (i.e., <28 weeks gestation) with low survival rates.[13] In addition, because black infants are more likely to be born at extremely preterm gestations,[14] we examined the possibility that higher mortality rates among black infants were due in part to systematic differences in the reporting of

Table 2. Early neonatal and fetal mortality rates (per 1,000 live births) and racial disparities by gestational category and fetal death registration area, U.S., 2000–2002

Fetal death area	Gestational age 20–22 weeks (n=14,415 births)					Gestational age 23–27 weeks (n=50,909 births)					Gestational age 28–32 weeks (n=61,604 births)					Gestational age 33–36 weeks (n=900,713 births)					Gestational age ≥37 weeks (n=9,762,364 births)				
	Total	*White*	*Black*	*RR*[a]	*RD*[b]	*Total*	*White*	*Black*	*RR*[a]	*RD*[b]	*Total*	*White*	*Black*	*RR*[a]	*RD*[b]	*Total*	*White*	*Black*	*RR*[a]	*RD*[b]	*Total*	*White*	*Black*	*RR*[a]	*RD*[b]
Early neonatal mortality rate																									
U.S.	747	768	720	0.9	–48[c]	188	200	170[d]	0.8	–30	21	22	18[c,d]	0.8	–4.3	3.3	3.5	2.7[d]	0.8	–0.8	0.5	0.5	0.7[d]	1.3	0.1
Area 1[e]	793	844	747	0.9	–97[c]	203	220	185[d]	0.8	–35	22	23	19	0.8	–4.7	3.3	3.4	2.9[d]	0.8	–0.5	0.5	0.5	0.7[d]	1.4	0.2
Area 2[f]	740	778	702	0.9	–77[c]	190	208	169[d]	0.8	–38	23	25	20	0.8	–4.7	3.5	3.8	2.8	0.7	–0.9	0.6	0.5	0.8[d]	1.4	0.2
Area 3[g]	813	797	835	1.1	38	193	207	166	0.8	–41	24	23	28	1.2	4.8	3.9	4.0	3.5	0.9	–0.4	0.6	0.6	0.8	1.4	0.2
Area 4[h]	733	748	711	1.0	–37[c]	183	193	164	0.9	–29	19[c]	21	15[c,d]	0.7	–5.3[c]	3.2	3.4	2.5[d]	0.7	–0.9	0.5	0.5	0.6	1.2	0.1
Fetal mortality rate																									
U.S.	605[c]	636[c]	556[c,d]	0.9	–80	227[c]	246[c]	196[c]	0.8	–50	59	58	61	1.2	3.8	11.0[c]	10.0[c]	13.0[d]	1.3	2.8	1.3	1.2	1.9[d]	1.6	0.7
Area 1[e]	709[c]	739[c]	675[c]	0.9	–63	259[c]	281[c]	235[c]	0.8	–46	67[c]	63	73[d]	1.2	10.0	12.0[c]	11.0[c]	15.0[d]	1.3	3.8	1.4	1.2	1.8[d]	1.5	0.6
Area 2[f]	564[c]	613[c]	501[c]	0.8	–112	210[c]	235[c]	178[c]	0.8	–57	58	58	57	1.0	–1.5	11.0[c]	10.0[c]	12.0[d]	1.2	2.1	1.3	1.2	2.0[d]	1.7	0.8
Area 3[g]	232	292	126[d]	0.4	–166	146	153	131	0.9	–22	55	54	58	1.1	3.9	10.0[c]	8.7	13.0[d]	1.5	4.1	1.2	1.1	2.2[d]	2.1	1.1
Area 4[h]	594[c]	624[c]	538[c,d]	0.9	–87	228[c]	246[c]	191[c]	0.8	–55	58	57	60	1.1	3.1	11.0[c]	10.0[c]	13.0[d]	1.3	2.6	1.2	1.2	1.8[d]	1.6	0.7

[a]Rate ratio = black rate / white rate

[b]Rate difference = black rate – white rate

[c]Statistically significant differences between fetal death reporting areas (Area 3 = referent)

[d]Statistically significant racial differences between mortality rates (white = referent)

[e]Area 1 = All products of conception

[f]Area 2 = Birthweight and gestational age criteria

[g]Area 3 = Birthweight only criteria

[h]Area 4 = Gestational age only criteria

RR = rate ratio

RD = rate difference

Table 3. Early neonatal and fetal mortality rates (per 1,000 fetuses at risk) and racial disparities by gestational category, U.S., 2000–2002

Gestational category and fetal death area	*Early neonatal mortality rate*					*Fetal mortality rate*				
	Total	*White*	*Black*	*RR*[a]	*RD*[b]	*Total*	*White*	*Black*	*RR*[a]	*RD*[b]
At 20 weeks										
U.S.	0.79	0.54	2.07[c]	3.83	1.53	1.61	1.23	3.59[c]	2.92	2.36
Area 3[d]	0.89	0.59	2.78[c,e]	4.71	2.19	0.33[e]	0.31[e]	0.48[e]	1.55	0.17
At 23 weeks										
U.S.	0.88	0.67	1.92[c]	2.87	1.25	1.37	1.09	2.79[c]	2.56	1.70
Area 3[d]	0.92	0.75	2.00[c]	2.67	1.25	0.81[e]	0.65[e]	1.81[c,e]	2.78	1.16
At 28 weeks										
U.S.	0.28	0.26	0.43[c]	1.65	0.17	0.93	0.75	1.87[c]	2.49	1.12
Area 3[d]	0.35	0.29	0.68[c,e]	2.34	0.39	0.92	0.78	1.81[c]	2.32	1.03
At 33 weeks										
U.S.	0.28	0.27	0.32[c]	1.19	0.05	0.92	0.80	1.57[c]	1.96	0.77
Area 3[d]	0.35[e]	0.34	0.45	1.32	0.11	0.87	0.75	1.66[c]	2.21	0.91
At 37 weeks										
U.S.	0.50	0.50	0.70[c]	1.40	0.20	1.28	1.17	1.88[c]	1.61	0.71
Area 3[d]	0.60[e]	0.60[e]	0.80	1.35	0.21	1.22	1.07	2.21[c]	2.07	1.14

[a]Rate ratio = black rate / white rate

[b]Rate difference = black rate – white rate

[c]Indicates statistically significant racial differences between mortality rates (white = referent)

[d]Area 3 = birthweight only criteria

[e]Indicates statistically significant differences between fetal death reporting areas (United States = referent)

RR = rate ratio

RD = rate difference

extremely preterm live births and fetal deaths by reporting area.

Our results indicate that fetal death reporting requirements contribute to substantial differences in fetal death reporting at lower gestational ages. In the four states that use only birthweight as the lowest threshold for reporting deaths, we noted substantially fewer fetal deaths prior to 23 weeks gestation. This magnitude of reduction in fetal deaths at 20–22 weeks gestation in area 3 was not fully accounted for by the increase in early neonatal deaths, suggesting that a large number of fetal deaths in area 3 may not have been recorded at all. Although not always statistically significant, early neonatal mortality rates were also high in area 3 at 28–32 weeks and 33–36 weeks gestation, suggesting that some births recorded as fetal deaths in other reporting areas might have been reported as live births and subsequent early neonatal deaths in area 3.

This deficit may stem from the fact that weight is often not recorded in fetal deaths, especially when they occur at early gestational ages. When fetal birthweight is unknown, and gestational age is not a criterion for reporting, many small and immature fetal deaths may simply not be recorded at all in area 3. An examination of fetal mortality rates among births with unknown gestational ages demonstrated similar findings, with fetal death reporting area 3 as having the lowest mortality rates (results not shown).

Next, because of the consistently higher early neonatal mortality rates in area 3 (especially in the fetuses-at-risk analysis), our data suggest that some displacement of fetal deaths to early neonatal deaths occurs in relation to fetal death reporting requirements. This displacement was slightly more pronounced in black infants and could account for a portion of the excess disparity seen in area 3 compared with the rest of the U.S.

While both absolute and relative disparity measures demonstrated similar findings by gestational age at death (e.g., early neonatal), the absolute RD was more sensitive to variation in reporting area differences. Variation in disparity measure sensitivity was largely due to the size of mortality rates, with the RD more sensitive to high overall mortality rates and the RR more sensitive to low overall mortality rates.

Black infants, who have higher rates of extremely preterm birth,[14–17] also had a slight survival advantage at extremely preterm gestations. When using traditional methods to calculate mortality rates, this survival advantage was not present in all fetal death registration areas.

Black infants born at 20–22 weeks gestation in area 3 had early neonatal mortality rates that were slightly higher than their white counterparts. This lack of a black survival advantage among infants born at 20–22 weeks gestation in area 3 could partially account for the higher absolute and relative disparities seen in this reporting area. Corresponding to this finding were the much lower relative and absolute fetal death disparities in area 3, similar to the mortality rates seen in area 3.

The question of whether lower black fetal mortality rates across the U.S. are real or a result of racial differences in reporting has been the cause of some debate.[3,5,18,19] Wingate et al. found some evidence of fetal death underreporting among black people, with black infants in their national study being 20% less likely than white infants to be classified as a fetal death vs. an early neonatal or neonatal death.[5] Cai et al. found that fetal mortality rates among black infants born at <28 weeks gestation and those born weighing <1,000 grams were significantly lower than their white counterparts, but they attributed this finding to the formula used to calculate fetal mortality rates.[18] Specifically, the denominator used to calculate fetal mortality rates consists of the total number of births at a specific gestational age + the number of fetal deaths. Because black infants are more likely to be born at extremely preterm gestations, they have a larger denominator and a subsequently lower fetal mortality rate. This finding argues for using the fetuses-at-risk approach.

Other factors that may contribute to our findings include state-level differences in several social and demographic factors such as the racial/ethnic composition of the state, percentage of the population living below the poverty level, and percentage of the population that is unemployed. An examination of several key factors, based on the 2000 Census, indicated that area 3 states were similar to the rest of the U.S. in most factors, with the exception of the following: black people represented a lower proportion of the population in area 3 states compared with the rest of the U.S. (area 3 = 6.2% vs. U.S. = 11.3%); and area 3 states had a lower average population density (per square mile of land) than the rest of the U.S. (area 3 = 49.0 vs. U.S. = 387.6). However, both of these differences were unlikely to explain our results.

Limitations and strengths

The findings of this study were subject to several limitations. First, reporting of fetal deaths, especially those occurring at <28 weeks gestation, is probably incomplete everywhere.[13] Our exclusion of births missing information on gestational age could have biased our results if factors related to missing information were differentially related to fetal death reporting area. When cases with missing information were examined, however, the trends we describe remained. In addition, the relatively small number of births missing information on gestational age (n=108,784 [white = 95,590, black = 13,194]) makes it unlikely that this factor seriously influenced our findings. Additionally, this analysis did not examine differences in live birth reporting, but further analyses (not shown) indicated that slight differences in state definitions of a live birth did not largely influence our results.

Despite these limitations, this study had several strengths. First, we used both traditional methods and the fetuses-at-risk approach when calculating early neonatal and fetal mortality rates. Second, we made use of a very large national sample of vital statistics data. Third, this study appears to be the first to examine the effect of state fetal death reporting requirements on racial disparities in infant, early neonatal, and/or fetal mortality. Fourth, we used both relative and absolute disparity measures, which were found to vary in their sensitivity to reporting area differences.

CONCLUSIONS

State differences in fetal death reporting requirements appear to influence important differences in the reported number of early neonatal deaths and fetal deaths. These differences were seen most clearly in the four states (Nebraska, New Mexico, South Dakota, and Tennessee) whose requirement for fetal death reporting depends only on birthweight. Although the largest effects of this difference in fetal death reporting were found in the underreporting of fetal mortality rates, it appears to also be associated with higher neonatal mortality rates, especially in black infants. The adoption of a uniform criterion for reporting fetal deaths in all states would reduce systematic differences in the reporting of live births and fetal deaths, and give a more accurate record of state early neonatal and fetal mortality rates and their associated racial disparities.

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