The Contribution of Mild and Moderate Preterm Birth to Infant Mortality

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Context The World Health Organization defines preterm birth as birth at less than 37 completed gestational weeks, but most studies have focused on very preterm infants (birth at <32 weeks) because of their high risk of mortality and serious morbidity. However, infants born at 32 through 36 weeks are more common and their public health impact has not been well studied.

Objective To assess the quantitative contribution of mild (birth at 34-36 gestational weeks) and moderate (birth at 32-33 gestational weeks) preterm birth to infant mortality.

Design, Setting, and Participants Population-based cohort study using linked singleton live birth–infant death cohort files for US birth cohorts for 1985 and 1995 and Canadian birth cohorts (excluding Ontario) for 1985-1987 and 1992-1994.

Main Outcome Measures Relative risks (RRs) and etiologic fractions (EFs) for overall and cause-specific early neonatal (age 0-6 days), late neonatal (age 7-27 days), postneonatal (age 28-364 days), and total infant death among mild and moderate preterm births vs term births (at ≥37 gestational weeks).

Results Relative risks for infant death from all causes among singletons born at 32 through 33 gestational weeks were 6.6 (95% confidence interval [CI], 6.1-7.0) in the United States in 1995 and 15.2 (95% CI, 13.2-17.5) in Canada in 1992-1994; among singletons born at 34 through 36 gestational weeks, the RRs were 2.9 (95% CI, 2.8-3.0) and 4.5 (95% CI, 4.0-5.0), respectively. Corresponding EFs were 3.2% and 4.8%, respectively, at 32 through 33 gestational weeks and 6.3% and 8.0%, respectively, at 34 through 36 gestational weeks; the sum of the EFs for births at 32 through 33 and 34 through 36 gestational weeks exceeded those for births at 28 through 31 gestational weeks. Substantial RRs were observed overall for the neonatal (eg, for early neonatal deaths, 14.6 and 33.0 for US and Canadian infants, respectively, born at 32-33 gestational weeks; EFs, 3.6% and and 6.2% for US and Canadian infants, respectively) and postneonatal (RRs, 2.1-3.8 and 3.0-7.0 for US and Canadian infants, respectively, born at 32-36 gestational weeks; EFs, 2.7%-5.8% and 3.0%-7.0% for the same groups, respectively) periods and for death due to asphyxia, infection, sudden infant death syndrome, and external causes. Except for a reduction in the RR and EF for neonatal mortality due to infection, the patterns have changed little since 1985 in either country.

Conclusions Mild– and moderate–preterm birth infants are at high RR for death during infancy and are responsible for an important fraction of infant deaths.

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THE WORLD HEALTH ORGANIZATION defines preterm birth as a gestational age at birth of less than 37 completed gestational weeks.[1] Preterm birth is recognized as a major public health problem by both clinicians and researchers because it is the leading cause of infant mortality in industrialized countries and also contributes to substantial neurocognitive, pulmonary, and ophthalmologic morbidity.[2-5] Caring for preterm infants also incurs large health care expenditures.[6] Most studies of morbidity and mortality among preterm infants have focused on those born very preterm, ie, at gestational ages less than 32 weeks.[7-17] For infants born at 32 through 36 gestational weeks, the risks are much lower, especially with recent advances in neonatal intensive care.[7,16] On the other hand, from a public health perspective, births at gestational ages of 32 through 36 weeks are much more common than those at less than 32 gestational weeks.[7,18] Thus it is important to distinguish absolute risk both from relative risk (RR) and from public health impact (ie, etiologic fraction [EF]).

The RR indicates how much more frequently a given outcome occurs in persons with vs those without a risk factor. The EF is the proportion of all cases of the outcome occurring in a given population that can be attributed to exposure to the risk factor; it is sometimes referred to as the population-attributable risk.[19] Because the EF is a function of both the RR and the population prevalence of exposure to the risk factor, common risk factors

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account for much higher EFs than do rare risk factors. For example, an anomalous coronary artery is associated with a very high RR of myocardial infarction but (owing to its extreme rarity) a very low EF. By contrast, cigarette smoking, which is highly prevalent, accounts for an appreciable portion of myocardial infarctions despite its modestly elevated RR.

We hypothesized that mild and moderate preterm births, which we define as live births at 34 through 36 and 32 through 33 completed weeks of gestation, respectively, are associated with an increased risk of infant mortality relative to term births. We further hypothesized that mild and moderate preterm births account for an important fraction of infant deaths. In particular, we suspected that the increased RRs and substantial EFs for infant death would be most pronounced for specific groups of causes (infection, sudden infant death syndrome [SIDS], and external causes such as unintentional injuries and abuse) and would be concentrated in the postneonatal rather than the neonatal period. Finally, we hypothesized that these increased risks would be observed in both the United States and Canada and would have diminished only slightly over time.

METHODS

We used 4 data sources for our analysis, all based on linked live birth–infant death cohort files. For the United States, we used the 1985 (n = 3 619 650) and 1995 (n = 3 866 513) birth cohorts, and for Canada, we used the files for 1985-1987 (n = 692 579) and 1992-1994 (n = 726 435) after excluding the province of Ontario because of documented problems with data quality. We used 3 years for each time period in Canada to increase the number of deaths in the file and thus provide more stable estimates of risk. Data from Newfoundland were not available for the earlier period. For the US file, gestational age is based on the algorithm used by the National Center for Health Statistics, which is calculated from date of the last menstrual period unless the last menstrual period is not reported or birth weight is incompatible with the reported gestational age, in which case the clinical estimate (as recorded on the birth certificate) is substituted. For the Canadian file, gestational age is that recorded on the birth certificate by the responsible physician, which, in recent years, appears to be based primarily on early ultrasound dating. For causes of death, we used the classification proposed by the International Collaborative Effort on Perinatal and Infant Mortality, which groups the *International Classification of Diseases, Ninth Revision (ICD-9)* codes for the underlying cause of death recorded on death certificates.[20] The International Collaborative Effort on Perinatal and Infant Mortality grouping includes congenital conditions, immaturity-related conditions, asphyxia-related conditions, infections, other specific conditions, SIDS, external causes, and remaining causes.

For data analysis, we restricted the study sample to singleton live births and categorized age at death as early neonatal (age 0-6 days), late neonatal (age 7-27 days), or postneonatal (age 28-364 days). We calculated risks for late neonatal death based on early neonatal survivors and risks for postneonatal death based on late neonatal survivors. Cause-specific mortality risks are based on all infants at risk of death for each cause; ie, they include infants dying of other causes in the denominator. Effects were expressed as adjusted RRs and 95% confidence intervals and EFs based on multiple logistic regression analyses; term (≥37 completed gestational weeks) births served as the reference group for these calculations. Odds ratios were converted to RRs using the method of Zhang and Yu.[21] The US regression models were adjusted for maternal age (age <20, 20-34, and ≥35 years), parity (primiparous vs multiparous), race (non-Hispanic white, non-Hispanic black, Hispanic, and other), and education (<12, 12, 13-15, and ≥16 completed years of school), while only age and parity were available for adjustment in the Canadian file. All analyses were performed with SAS-PC version 6.12 (SAS Institute, Cary, NC).

Etiologic fractions for the polychotomous categories of preterm birth (birth at <28, 28-31, 32-33, and 34-36 gestational weeks) were based on the method of Miettinen[19] as follows:

$$EF = \frac{P_i\,(RR_i - 1)}{\Sigma P_i\,(RR_i - 1) + 1}$$

where P_i is the prevalence of the ith preterm gestational age category (<28, 28-31, 32-33, or 34-36 weeks), RR_i is the corresponding RR of mortality in that group relative to term (birth at ≥37 gestational weeks) infants and Σ indicates summation over the i preterm categories.

RESULTS

Infant mortality rates and gestational age distributions among all live births are shown in TABLE 1 for both countries and both time periods. Preterm birth rates and early neonatal, late neonatal, and postneonatal mortality rates were all lower in Canada than in the United States for both time periods. Mild (34-36 gestational weeks) preterm births comprised 6.3% and 7.6% of all US live births in 1985 and 1995, respectively; the proportions in Canada were 4.5% in 1985-1987 and 4.9% in 1992-1994. For moderate (32-33 gestational weeks) preterm births, the corresponding rates were 1.3% and 1.4% in the United States and 0.7% and 0.8% in Canada.

Because the RRs and EFs were similar for both time periods in both countries, data are presented only for the more recent period (1995 in the United States and 1992-1994 for Canada). For each category of preterm birth, TABLE 2 shows the crude absolute and adjusted RRs and EFs for infant death from all causes among all singleton live births. Separate estimates are shown for total infant mortality and early neonatal, late neonatal, and postneonatal mortality. As expected, RRs and EFs were

Table 1. Infant Mortality and Gestational Age Distribution Among All Live Births, United States, 1985 and 1995, and Canada, 1985-1987 and 1992-1994*

	United States		Canada	
Age Group	1985	1995	1985-1987	1992-1994
Infant Mortality, per 1000 Births				
Early neonatal (age 0-6 d)	5.7	4.0	4.1	3.3
Late neonatal (age 7-27 d)	1.1	1.0	0.9	0.7
Postneonatal (age 28-364 d)	3.6	2.6	2.9	2.2
Total	**10.4**	**7.5**	**7.8**	**6.2**
Gestational Age, Distribution %				
≤27 Weeks	0.7	0.7	0.4	0.4
28-31 Weeks	1.1	1.2	0.6	0.6
32-33 Weeks	1.3	1.4	0.7	0.8
34-36 Weeks	6.3	7.6	4.5	4.9
≥37 Weeks	86.7	88.2	93.7	92.6
Unknown	3.9	0.9	0.2	0.8

*Canadian data exclude Ontario.

highest for births at less than 28 gestational weeks. Infants born at 32 through 33 gestational weeks were at high RR of infant death in both countries. To our surprise, the largest RRs were seen in the neonatal period. For infants born at 34 through 36 gestational weeks, the RRs were somewhat lower but still substantial and statistically significant. In general, the RRs were higher in Canada than in the United States. The EFs ranged from 3.0% to 6.2% for infants born at 32 through 33 gestational weeks and 5.8% to 9.0% for those born at 34 through 36 gestational weeks and were slightly higher in Canada. The sum of the EFs for 32 through 33 and 34 through 36 gestational weeks exceeded those for infants born at 28 through 31 gestational weeks for all 3 ages at death.

Congenital anomalies may lead to either spontaneous or iatrogenic preterm delivery, but preterm birth cannot cause these anomalies (although it can increase the risk of death among infants with anomalies). TABLE 3 presents a similar analysis to that shown in Table 2 after excluding deaths due to congenital conditions. The RRs and EFs are only slightly lower than those shown in Table 2.

Fewer moderately or mildly preterm infants died of asphyxia-related conditions, and this resulted in rather wide confidence intervals for the RRs. Nonetheless, the risks were quite elevated, especially for infants born at 32 through 33 gestational weeks, as shown in TABLE 4. As expected for this group of causes, the excess deaths were concentrated in the neonatal period in both countries. The EFs were substantial for neonates born at 34 through 36 gestational weeks.

For deaths due to infection, we had hypothesized increased risks in the postneonatal period. As shown in TABLE 5, this hypothesis was confirmed for both mild and moderate preterm births in both countries, although we were surprised to observe even higher RRs of death from infection in the early and late neonatal periods than those in the postneonatal period. Etiologic fractions were 4.2% to 5.4% for births at 32 through 33 gestational weeks and ranged from 1.9% to 10.9% for births at 34 through 36 gestational weeks. Additional adjustment for maternal smoking for the 1995 US cohort had little effect on RRs. With adjustment for smoking, RR at 32 through 33 gestational weeks was 8.0, the same as without adjustment, and at 34 through 36 weeks, 3.0, compared with 3.1 without adjustment. For infants born at 34 through 36 gestational weeks, EFs for early and late neonatal death due to infection decreased between the 2 time periods, eg, in the United States the EF decreased from 16.0% in 1985 to 10.9% in 1995 for early neonatal death and from 12.3% to 5.3% for late neonatal death. These were the only consistent temporal changes observed.

TABLE 6 summarizes the results for postneonatal deaths due to SIDS and all external causes. The RRs ranged from 1.7 to 1.9 in the mild preterm category and 2.4 to 4.4 in the moderate preterm category, and most were statistically significant; for SIDS and all external causes, these RRs were slightly but nonsignificantly higher in Canada than in the United States. In both countries, EFs ranged from 1.5% to 2.0% for births at 32 through 33 gestational weeks but rose to 3.8% to 5.1% for infants born at 34 through 36 gestational weeks. The latter values exceeded the total EFs for infants born at less than 28 and 28 through 31 gestational weeks. Additional adjustment for maternal smoking for the 1995 US cohort had little effect on the RRs for SIDS. With adjustment, the RR at 32 through 33 gestational weeks was 2.1 vs 2.4 without adjustment, and at 34 through 36 gestational weeks, 1.6 vs 1.7 without adjustment.

COMMENT

Most of our hypotheses were supported by the data. Mildly and moderately preterm infants did indeed have high RRs and appreciable EFs for postneonatal deaths due to infection, SIDS, and external causes, including abuse and maltreatment. We were surprised, however, to observe that their risks were also elevated for neonatal death, especially neonatal death due to asphyxia and infection. Our results highlight the difference between the clinical and public health perspectives, ie, between absolute risk, on the one hand, and RR and EF, on the other.

Despite the low absolute risks of death in these gestational age groups,

Table 2. Risks and Etiologic Fractions for All-Cause Infant Death Among Singleton Live Births at Less Than 37 Gestational Weeks, United States, 1995, and Canada, 1992-1994*

	United States, 1995			Canada, 1992-1994		
Mortality by Age	Crude Risk†	RR (95% CI)‡	EF, %	Crude Risk†	RR (95% CI)§	EF, %
			<28 Weeks			
Early neonatal	330.4	465.5 (449.2-482.0)	59.9	434.0	496.2 (463.1-529.9)	44.6
Late neonatal	59.3	129.7 (119.1-141.2)	27.7	68.2	185.6 (145.4-235.9)	19.3
Postneonatal	60.9	27.0 (25.1-29.1)	7.7	63.2	36.9 (29.2-46.6)	4.7
Total infant	408.5	126.7 (124.0-129.5)	35.7	506.0	170.7 (162.5-178.7)	26.9
			28-31 Weeks			
Early neonatal	28.1	40.1 (37.3-43.2)	8.6	61.4	70.2 (60.2-81.7)	10.0
Late neonatal	9.3	20.2 (17.9-22.8)	10.0	9.8	26.6 (18.3-38.6)	7.1
Postneonatal	16.8	7.4 (6.8-8.1)	4.9	17.0	9.6 (7.3-12.6)	3.1
Total infant	53.3	16.2 (15.4-17.0)	7.3	86.4	28.8 (25.6-32.4)	7.1
			32-33 Weeks (Moderate Preterm Birth)			
Early neonatal	10.2	14.6 (13.2-16.2)	3.6	28.8	33.0 (27.3-39.8)	6.2
Late neonatal	2.8	6.3 (5.3-7.6)	3.4	4.8	13.1 (8.4-20.4)	4.6
Postneonatal	8.4	3.8 (3.4-4.3)	2.7	12.0	7.0 (5.3-9.2)	3.0
Total infant	21.2	6.6 (6.1-7.0)	3.2	45.1	15.2 (13.2-17.5)	4.8
			34-36 Weeks (Mild Preterm Birth)			
Early neonatal	3.6	5.2 (4.8-5.6)	6.3	6.9	7.9 (6.7-9.2)	9.0
Late neonatal	1.3	2.8 (2.5-3.2)	6.8	1.3	3.6 (2.6-5.0)	6.9
Postneonatal	4.3	2.1 (1.9-2.2)	5.8	5.2	3.0 (2.5-3.5)	7.0
Total infant	9.2	2.9 (2.8-3.0)	6.3	13.3	4.5 (4.0-5.0)	8.0

*See footnotes to Table 3.

Table 3. Risks and Etiologic Fractions for Infant Death Due to All Causes Except Congenital Conditions Among Singleton Live Births at Less Than 37 Gestational Weeks, United States, 1995, and Canada, 1992-1994*

	United States, 1995			Canada, 1992-1994		
Mortality by Age	Crude Risk†	RR (95% CI)‡	EF, %	Crude Risk†	RR (95% CI)§	EF, %
			<28 Weeks			
Early neonatal	304.9	1143.2 (1083.1-1205.0)	77.0	394.9	1028.6 (935.6-1124.5)	62.5
Late neonatal	55.5	263.9 (237.6-292.9)	40.4	61.4	415.6 (309.7-554.5)	34.4
Postneonatal	54.7	31.4 (29.1-34.0)	9.0	56.9	46.9 (36.5-60.1)	5.9
Total infant	376.5	185.4 (180.7-190.2)	45.4	459.7	261.6 (247.1-276.2)	37.1
			28-31 Weeks			
Early neonatal	16.9	64.4 (58.0-71.5)	7.2	34.9	90.4 (72.9-111.9)	8.7
Late neonatal	7.7	36.3 (31.4-41.9)	13.3	7.0	46.7 (29.4-74.1)	10.1
Postneonatal	13.4	7.6 (6.9-8.4)	5.1	13.5	10.6 (7.8-14.4)	3.5
Total infant	37.2	17.6 (16.6-18.7)	6.9	53.9	30.0 (25.7-34.9)	6.6
			32-33 Weeks (Moderate Preterm Birth)			
Early neonatal	3.5	13.6 (11.4-16.2)	1.7	13.2	34.2 (25.8-45.3)	4.3
Late neonatal	1.4	7.1 (5.5-9.2)	2.8	2.3	15.5 (8.1-29.7)	4.4
Postneonatal	6.0	3.6 (3.1-4.0)	2.4	9.2	7.5 (5.5-10.3)	3.3
Total infant	10.8	5.3 (4.9-5.8)	2.2	24.3	13.7 (11.3-16.6)	3.9
			34-36 Weeks (Mild Preterm Birth)			
Early neonatal	1.2	4.5 (3.9-5.2)	2.8	2.2	5.6 (4.3-7.4)	4.1
Late neonatal	0.6	2.9 (2.5-3.5)	5.2	0.3	2.0 (1.0-4.0)	2.1
Postneonatal	3.2	2.0 (1.8-2.1)	5.4	3.3	2.6 (2.1-3.2)	5.7
Total infant	4.9	2.5 (2.3-2.6)	4.3	5.7	3.2 (2.7-3.7)	4.5

*RR indicates relative risk; CI, confidence interval; EF, etiologic fraction; early neonatal, age 0-6 days; late neonatal, age 7-27 days; and postneonatal, age 28-364 days. Canadian data exclude Ontario.
†Crude risk is per 1000 live births.
‡Adjusted for age, parity, race, and education; infants born at 37 gestational weeks or later were used as reference.
§Adjusted for age and parity; infants born at 37 gestational weeks or later were used as reference.

the RRs are quite elevated and, when combined with their larger numbers compared with more extreme preterm births, translate into a substantialimpact at the population level. In fact, the combined impact exceeded that of infants born at 28 through 31 gestational weeks for all causes and all 3 ages at death and even that of infants born at less than 28 gestational weeks for postneonatal deaths. These findings do not in any way diminish the clinical and public health importance of extremely preterm infants. Infants born at 27 gestational weeks or earlier account for a very large proportion of neonatal deaths despite their rare occurrence (0.7% in the United States and 0.4% in Canada).

Our results were fairly consistent between the United States and Canada. The RRs of mortality associated with mild and moderate preterm birth were generally higher in Canada. A small part of these differences in gestational age–specific mortality was explained by the lower absolute and relative mortality risks among US black vs white preterm infants, but the RRs for Canada remained substantially higher than those for the United States even after restricting the US analysis to non-Hispanic whites (ie, 8.1 vs 15.2 at 32-33 gestational weeks and 3.3 vs 4.5 at 34-36 gestational weeks for total infant mortality among all singleton live births). An even smaller part of the difference was the result of the slightly lower absolute risks for term (birth at ≥37 gestational weeks) births in Canada (ie, total infant mortality of 3.0 vs 3.1 per 1000 live births for Canada in 1992-1994 vs the United States in 1995). We are currently investigating other potential explanations and particularly whether the differences might be artifacts caused by errors in estimation of gestational age.[22] Regardless of the explanation, however, the prevalence of births in these gestational age categories was much lower in Canada than in the United States, and the EFs were therefore similar in the 2 countries.

Except for a slight reduction in neonatal deaths attributable to infection among infants born at 34 through 36 gestational weeks, the patterns we observed have not changed much over the last 10 years in either country. In other words, despite the continued reduction in gestational age–specific mortality with improvements in high-risk obstetric and neonatal care,[13,17,23] mild and moderate preterm births continue to contribute an important fraction of infant deaths from a variety of causes. Obstetricians should be aware of these risks when contemplating preterm induction or cesarean delivery, and pediatricians may

Table 4. Risks and Etiologic Fractions for Infant Death Due to Asphyxia-Related Conditions Among Singleton Live Births at Less Than 37 Gestational Weeks, United States, 1995, and Canada, 1992-1994*

	United States, 1995			Canada, 1992-1994		
Mortality by Age	Crude Risk†	RR (95% CI)‡	EF, %	Crude Risk†	RR (95% CI)§	EF, %
			<28 Weeks			
Early neonatal	21.2	253.6 (217.7-295.4)	51.4	60.0	295.8 (233.5-373.3)	40.3
Late neonatal	1.8	63.8 (40.5-100.3)	15.8	3.0	93.6 (37.5-233.1)	16.2
Postneonatal	0.6	29.3 (13.0-66.2)	8.5	1.0	78.1 (16.5-369.1)	15.7
Total infant	22.8	180.7 (157.7-206.8)	43.7	63.8	257.9 (206.6-320.9)	37.0
			28-31 Weeks			
Early neonatal	2.0	21.9 (16.8-28.7)	7.2	7.1	35.1 (22.7-54.1)	7.4
Late neonatal	0.6	22.2 (13.8-35.8)	13.2	0.9	27.3 (8.1-92.1)	7.8
Postneonatal	0.1	5.0 (1.5-16.0)	3.1	0.6	44.8 (9.5-212.3)	15.1
Total infant	2.7	20.1 (16.0-25.3)	7.9	8.6	34.6 (23.3-51.4)	7.8
			32-33 Weeks (Moderate Preterm Birth)			
Early neonatal	0.6	7.5 (5.1-11.1)	2.7	1.1	5.5 (2.2-13.3)	1.3
Late neonatal	0.1	2.6 (0.8-8.0)	1.2	0.7	20.6 (6.1-69.6)	7.8
Postneonatal	0.02	1.4 (0.2-10.0)	0.4	0.0	0.0	. . .
Total infant	0.7	5.8 (4.0-8.3)	2.4	1.8	7.2 (3.5-14.5)	1.9
			34-36 Weeks (Mild Preterm Birth)			
Early neonatal	0.3	3.0 (2.3-3.9)	4.7	0.7	3.6 (2.3-5.6)	5.1
Late neonatal	0.1	2.6 (1.5-4.3)	6.9	0.1	3.1 (0.9-10.5)	5.7
Postneonatal	0.04	2.6 (1.3-5.1)	8.6	0.0	0.0	. . .
Total infant	0.4	2.9 (2.3-3.6)	5.3	0.8	3.3 (2.2-5.1)	4.9

*RR indicates relative risk; CI, confidence interval; EF, etiologic fraction; early neonatal, age 0-6 days; late neonatal, age 7-27 days; postneonatal, age 28-364 days; and ellipses, not applicable. Canadian data excludes Ontario.
†Crude risk is per 1000 live births.
‡Adjusted for age, parity, race, and education; infants born at 37 gestational weeks or later were used as reference.
§Adjusted for age and parity; infants born at 37 gestational weeks or later were used as reference.

Table 5. Risks and Etiologic Fractions for Infant Death Due to Infection Among Singleton Live Births at Less Than 37 Gestational Weeks, United States, 1995, and Canada, 1992-1994*

	United States, 1995			Canada, 1992-1994		
	Crude Risk†	RR (95% CI)‡	EF, %	Crude Risk†	RR (95% CI)§	EF, %
			<28 Weeks			
Early neonatal	6.5	165.0 (128.2-212.4)	35.1	70.0	1500.3 (1038.5-2146.0)	57.8
Late neonatal	13.5	315.2 (250.5-396.4)	42.8	12.8	424.6 (236.2-760.0)	42.9
Postneonatal	17.8	79.6 (68.2-92.8)	18.2	9.9	60.0 (36.9-97.3)	10.8
Total infant	26.8	91.5 (82.0-102.0)	27.1	91.0	376.8 (309.2-457.4)	39.2
			28-31 Weeks			
Early neonatal	1.4	37.3 (26.9-51.7)	13.2	13.1	280.2 (177.4-441.3)	17.2
Late neonatal	1.8	43.8 (32.5-59.1)	14.3	2.4	80.4 (35.4-182.6)	13.7
Postneonatal	3.7	16.7 (13.8-20.2)	9.4	5.4	32.7 (19.8-53.7)	9.9
Total infant	6.8	23.0 (19.9-26.5)	11.2	20.9	86.0 (65.1-113.4)	14.2
			32-33 Weeks (Moderate Preterm Birth)			
Early neonatal	0.5	12.3 (7.7-19.6)	4.9	3.1	67.1 (35.7-126.0)	5.4
Late neonatal	0.4	9.9 (6.1-16.2)	3.6	0.7	22.2 (6.6-74.9)	4.9
Postneonatal	1.5	6.7 (5.2-8.7)	4.2	2.2	13.7 (7.2-26.2)	5.4
Total infant	2.4	8.0 (6.5-9.8)	4.3	6.0	25.1 (16.7-37.6)	5.4
			34-36 Weeks (Mild Preterm Birth)			
Early neonatal	0.2	5.3 (3.9-7.4)	10.9	0.6	12.6 (7.1-22.6)	6.5
Late neonatal	0.1	3.2 (2.2-4.7)	5.3	0.1	2.2 (0.5-9.3)	1.9
Postneonatal	0.5	2.5 (2.1-3.1)	6.6	0.6	3.4 (2.0-5.6)	6.9
Total infant	0.9	3.1 (2.6-3.5)	7.2	1.2	5.0 (3.5-7.2)	6.1

*RR indicates relative risk; CI, confidence interval; EF, etiologic fraction; early neonatal, age 0-6 days; late neonatal, age 7-27 days; and postneonatal, age 28-364 days. Canadian data exclude Ontario.
†Crude risk is per 1000 live births.
‡Adjusted for age, parity, race, and education; infants born at 37 gestational weeks or later were used as reference.
§Adjusted for age and parity; infants born at 37 gestational weeks or later were used as reference.

Table 6. Risks and Etiologic Fractions for Postneonatal Death Due to SIDS and All External Causes Among Singleton Live Births at Less Than 37 Gestational Weeks, United States, 1995, and Canada, 1992-1994*

	United States, 1995			Canada, 1992-1994		
Cause of Death	Crude Risk‡	RR (95% CI)‡	EF, %	Crude Risk†	RR (95% CI)§	EF, %
			<28 Weeks			
SIDS	4.2	3.6 (2.8-4.7)	0.9	2.9	3.6 (1.6-8.0)	0.7
All external causes	0.7	3.2 (1.7-6.1)	0.8	0.0	0.0	Undefined
			28-31 Weeks			
SIDS	4.5	4.0 (3.4-4.7)	2.6	1.5	1.8 (0.8-4.4)	0.3
All external causes	0.7	2.9 (1.9-4.4)	1.7	0.0	0.0	Undefined
			32-33 Weeks (Moderate Preterm Birth)			
SIDS	2.5	2.4 (2.0-2.8)	1.5	3.1	4.0 (2.3-6.8)	1.8
All external causes	0.5	2.6 (1.7-3.9)	1.8	0.4	4.4 (1.1-17.9)	2.0
			34-36 Weeks (Mild Preterm Birth)			
SIDS	1.7	1.7 (1.5-1.9)	4.4	1.5	1.9 (1.4-2.6)	3.8
All external causes	0.3	1.8 (1.4-2.3)	5.1	0.2	1.9 (0.8-4.4)	3.8

*SIDS indicates sudden infant death syndrome; external causes, causes of death such as unintentional injuries and abuse; RR, relative risk; CI, confidence interval; and EF, etiologic fraction. Canadian data exclude Ontario.
†Crude risks per 1000 live births.
‡Adjusted for age, parity, race, and education; infants born at 37 gestational weeks or later were used as reference.
§Adjusted for age and parity; infants born at 37 gestational weeks or later were used as reference.

wish to consider closer monitoring of mildly and moderately preterm infants after hospital discharge. Perinatal researchers should include births in these gestational age categories in studies of etiology and prevention. Our findings indicate that preventing the occurrence of mild and moderate preterm births and of death among such births remain worthy targets for future research and clinical intervention.

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> The sciences and arts are not cast in a mold, but are formed and shaped little by little, by repeated handling and polishing, as the bears lick their cubs into shape at leisure.
>
> —Michel de Montaigne (1533-1592)