Injury related infant death: the impact of race and birth weight

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Abstract

***Objective*—To examine the effect of race and birth weight independent of other sociodemographic factors on injury related infant death using national data.**

***Setting*—Infants born in the United States to mothers who were white (non-Hispanic), African American, Mexican American, and Native American.**

***Methods*—Linked infant birth and death data from the National Center for Health Statistics for 1989–91 were analyzed to calculate unadjusted and adjusted odds ratios for death due to homicide or unintentional injury within the first year of life. In addition to maternal race and birth weight, the risk of death was adjusted for maternal age, prenatal care, maternal education, paternal education, marital status, birth order, interval since last pregnancy, smoking during pregnancy, and alcohol intake during pregnancy.**

***Results*—Among 10.7 million births during 1989–91, 821 homicides and 2397 unintentional deaths were reported in infants. Relative to whites, African Americans were at highest risk for homicides (unadjusted and adjusted odds ratios = 3.6 (95% confidence interval = 3.1 to 4.2) and 1.6 (1.3 to 1.9), respectively) and Native Americans at highest risk for unintentional injuries (unadjusted and adjusted odds ratios = 3.8 (3.0 to 4.8) and 2.1 (1.7 to 2.6), respectively). After accounting for other sociodemographic factors, Mexican American infants appeared protected from injury (adjusted odds ratio = 0.7 (0.6 to 1.0) for homicides and 0.7 (0.6 to 0.8) for unintentional injuries). An inverse effect of birth weight was seen—as birth weight decreased, risk of homicides and unintentional injuries increased. After adjustment for the sociodemographic factors, very low birthweight babies were still at substantially increased risk of homicides with an odds ratio of 2.1 (1.4 to 3.1) and unintentional injuries with an odds ratio of 2.9 (2.4 to 3.7).**

***Conclusions*—Using a large national dataset, the effect of race as a risk factor for fatal infant injuries was mostly explained by birth weight and other sociodemographic factors. Preventable risk factors need to be identified for African Americans and Native Americans, in particular. Birth weight is an important independent risk factor; very low birthweight babies should be monitored for both homicide and unintentional injury.**

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Keywords: infant fatalities; homicides; race; birth weight

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Intentional and unintentional injuries are the fourth leading cause of death among infants in the United States, and the leading cause of preventable death.[1 2] In addition, almost half of all fatal childhood injuries occur in infants, resulting in great loss of potential years of life.[1] Non-white race has been previously reported to be a risk factor for injuries at all ages,[3 4] although in the United States this is thought to represent a correlation with low socioeconomic status.[3] However, the relationship between race or ethnicity and infant injuries, independent of socioeconomic status, has not been explored using national data.

Birth weight is the major determinant of infant mortality from all causes. Although previous reports,[5–8] have shown low birth weight to be a risk factor for both infant homicide and unintentional injury, its association independent of race has not been examined. Because birth weight, like race, is highly correlated with other markers of low socioeconomic status, the mechanism leading to fatal injury is not clear. It is possible that the same social factors that "cause" prematurity also make a child vulnerable to injury. Alternatively, it may be the condition of prematurity itself that makes a child more susceptible to trauma.

In the United States, both race and birth weight are highly correlated with socioeconomic status. Although other studies have examined risk factors for injuries using national data,[9–11] no study has tried to control for socioeconomic status and derive an estimate of the independent effect of race and birth weight. The purpose of our research, therefore, was to examine the independent associations of race (ethnicity) and birth weight with death during infancy due to homicide or unintentional injury.

Methods

SOURCE OF DATA

Since 1983, the National Center for Health Statistics has linked individual data from birth certificates and death certificates for children who died before their first birthday. This linked infant birth and death dataset is available to the public on CD-ROM.[12–14] The United States Standard Certificate of Live Birth was revised in 1989 to include many more health questions related to the wellbeing of the mother. The classification of many other variables, including race of the child and marital status, was also changed in 1989.

For the years 1989–91, we included information for infants born in the United States to

mothers who were white (non-Hispanic), African American, Mexican, and Native American. We excluded infants born to mothers of other racial/ethnic groups (for example, Asian American) due to small numbers of births. We also excluded unlinked death certificates, representing fewer than 2.5% of deaths for the period of study. The distribution of unlinked deaths is not random and varies by state, race, and birth weight. For example, African Americans have slightly higher rates of unlinked deaths, as do very low birthweight babies. Thus, the mortality estimates for these groups may slightly underestimate true rates.

CLASSIFICATION OF RACE/ETHNICITY

Race of the infant was defined as the race of the mother as listed on the birth certificate and we included the largest groups, non-Hispanic whites, African Americans, Native Americans, and Hispanics. However, some have suggested that because of the diversity of communities within the "Hispanic" classification, researchers should retain country or region of origin when studying health outcomes in Hispanic Americans.[15 16] Instead of including all Hispanics, therefore, we only included Mexican Americans, who represent the largest subgroup of Hispanics in the United States.[16] In this context, race and ethnicity were used interchangeably in the analysis.

DEFINITION OF BIRTHWEIGHT GROUPS

The dataset includes information on birth weight recorded in grams. We categorized birth weight into standard[17] groupings: very low birth weight = 500–1499 g, moderately low birth weight = 1500–2499 g, normal birth weight =2500–4000 g, and high birth weight = >4000 g. Infants whose birth weight was less than 500 g were not included in the sample, but infants with missing values for birth weight or any of the other sociodemographic variables were included in order to retain the greatest number of infants in the sample.

SOCIODEMOGRAPHIC FACTORS

In addition to race and birth weight, we chose nine variables, in three categories, from birth certificate data that were potential risk factors for homicides or unintentional injuries—maternal behaviors during pregnancy: alcohol intake, cigarette smoking, and adequacy of prenatal care; parental factors: marital status, maternal age, maternal education, and paternal education; and reproductive history: birth order, and interval since last pregnancy.

Maternal behaviors

Alcohol intake during pregnancy was measured as the reported number of drinks per week. Smoking was assessed by the number of cigarettes per day. Prenatal care was classified according to the Kessner index,[18] which is derived from number of prenatal visits, the month prenatal care began, and gestation.

Parental factors

Marital status and maternal age are categorized according to an item on birth certificates. When marital status is unknown, it was inferred by the matching of parents' surnames. Income and occupation were not available from birth certificates, but previous research has supported the validity of parental education as a proxy for socioeconomic status.[19]

Reproductive history

Factors related to reproductive history were birth order and interpregnancy interval (measured in the number of months between the current pregnancy and any previous pregnancy).

OUTCOMES

The dataset includes cause of death during the first year of life from the death certificate according to the *International Classification of Diseases* "E codes" (codes for external cause). A death was defined as homicide if the E code was E960–E969. This included deaths due to "child battering or other maltreatment" and "other homicide". Reporting of homicide on death certificates probably underestimates its true incidence.[20 21]

Unintentional deaths were defined according to E codes E800–E949, that is, deaths due to suffocation or choking, motor vehicle accidents, drowning, falls, fires, dangerous exposures (excessive heat or cold, being struck by falling object), and other unintentional injury.

The comparison groups were the remaining infants who survived to age 1 as well as those who died of other causes.

MISSING DATA

When information on maternal race/ethnicity was missing, the case was excluded; marital status and maternal age were imputed by the National Center for Health Statistics from vital statistics. We were able to include births for which other data were missing without reducing the size of the sample by creating dummy variables for each category of each risk factor, including an "unknown" category.

STATISTICAL ANALYSIS

All variables were coded using categorical scales when calculating unadjusted and adjusted odds ratios for the outcomes of homicide and unintentional death. Multivariable analysis using SAS 6.12 software and the Proc Logistic procedure was done to develop one logistic model for homicide, and a second for unintentional death. Since injury related deaths are infrequent, the odds ratios approximate risk ratios. If a risk factor was not significant at $p<0.05$ in the bivariate (unadjusted) analysis, it was still retained in the logistic model because an important effect can sometimes be unmasked in multivariable analysis.[22] We did not perform tests for specific statistical interactions or collinearity.

Results

During 1989–91, 10 671 666 United States births were recorded for mothers who were (non-Hispanic) white, African American,

Table 1 Impact of race on the risk of injury related infant death

		Homicide				Unintentional injury			
Risk factor	*No of births*	*No of deaths*	*Homicides/100 000 live births (95% CI)*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**	*No of deaths*	*Fatal injuries/100 000 live births (95% CI)*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**
Total	10 671 666	821				2397			
Race									
Non-Hispanic white	7 563 081	388	5.1 (4.6 to 5.7)	1.0	1.0	1373	18.2 (17.2 to 19.1)	1.0	1.0
African American	1 881 756	351	18.7 (16.8 to 20.7)	3.6 (3.1 to 4.2)	1.6 (1.3 to 1.9)	719	38.2 (35.5 to 41.1)	2.1 (1.9 to 2.3)	1.1 (1.0 to 1.2)
Mexican American	1 114 498	64	5.7 (4.4 to 7.3)	1.1 (0.9 to 1.5)	0.7 (0.6 to 1.0)	228	20.5 (17.9 to 23.3)	1.1 (1.0 to 1.3)	0.7 (0.6 to 0.8)
Native American	112 331	18	16 (9.5 to 25.3)	3.1 (1.9 to 5.0)	1.6 (1.0 to 2.5)	77	68.6 (54.1 to 85.7)	3.8 (3.0 to 4.8)	2.1 (1.7 to 2.6)

CI = confidence interval; OR = odds ratio.
*Adjusted odds ratios obtained from logistic regression models for homicide/unintentional injury including birth weight, alcohol intake, cigarette smoking, prenatal care, marital status, maternal age, maternal education, paternal education, birth order, and interpregnancy interval.

Mexican, or Native American. During these three years, 821 homicides and 2397 unintentional deaths were reported among these infants. The rates of homicide and fatal unintentional injuries per 100 000 live births for each racial group are given in table 1. African Americans had the highest rates of infant homicide (18.7 per 100 000 live births); Native Americans had the highest rates of fatal unintentional injuries (68.6 per 100 000 live births); and non-Hispanic whites had the lowest rates of both homicide (5.1 per 100 000 live births) and unintentional deaths (18.2 per 100 000 live births).

The results of separate logistic regression analyses for homicide and unintentional injury deaths are shown in tables 1 and 2, for race/ethnicity and birth weight, respectively.

RACE/ETHNICITY

Race/ethnicity was a strong predictor of infant mortality due to injury in bivariate analysis, but the effect was attenuated for all groups by adjustment for sociodemographic factors (table 1). Even after adjustment, however, African Americans and Native Americans remained at increased risk for homicide, and Native Americans at increased risk for unintentional injury. For African Americans, the odds ratio relative to whites dropped substantially following adjustment, from 3.6 (95% confidence interval = 3.1 to 4.2) to 1.6 (1.3 to 1.9) for homicide, and from 2.1 (1.9 to 2.3) to 1.1 (1.0 to 1.2) for unintentional injuries. For Native Americans, the odds ratio decreased from 3.1 (1.9 to 5.0) to 1.6 (1.0 to 2.5) after adjustment for homicide and from 3.8 (3.0 to 4.8) to 2.1 (1.7 to 2.6) for unintentional injury deaths. Mexican Americans were not at increased risk of fatal injuries relative to whites: after adjustment, the odds ratio changed from 1.1 (0.9 to 1.5) to protective at 0.7 (0.6 to 1.0) for homicides, and from 1.1 (1.0 to 1.3) to 0.7 (0.6 to 0.8) for unintentional injuries.

BIRTH WEIGHT

A dose-response effect was found for low birth weight: as birth weight decreased, risk for both homicide and unintentional injuries increased (table 2). Babies of very low birth weight (500–1499 g) were at increased risk of both types of injuries, with unadjusted odds ratios of 3.7 (2.5 to 5.5) for homicide and 4.1(3.3 to 5.0) for unintentional injuries. Adjustment for the 10 other sociodemographic factors reduced the odds ratios to 2.1(1.4 to 3.1) and 2.9 (2.4 to 3.7) for homicides and unintentional injuries, respectively. Moderately low birth weight (1500–2499 g) was also a risk factor for both homicide and unintentional injury (adjusted odds ratio = 1.6 (1.3 to 2.0) for homicide and 1.6 (1.4 to 1.8) for unintentional injuries). Large babies (birth weight >4000 g) were protected from both homicides and unintentional injuries, with adjusted odds ratios of 0.8 (0.6 to 1.1) for homicides and 0.7 (0.6 to 0.8) for unintentional injuries, relative to normal weight babies. Less than 0.1% of birth certificates were missing information on birth weight. When birth weight was missing, however, the risk of homicides (adjusted odds ratio = 17.7 (11.5 to 27.2)) and unintentional injuries (adjusted odds ratio = 4.6 (2.7 to 7.9)) was markedly increased relative to the normal birthweight group.

OTHER SOCIODEMOGRAPHIC FACTORS

Tables 3–5 show the contribution of each of the nine sociodemographic factors to the risk of injury related infant death.

Table 2 Impact of birth weight on the risk of injury related infant death

		Homicide			Unintentional injury		
Risk factor	*No of births*	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**
Total	10 671 666	821			2397		
Birth weight (g)							
2500–4000	8 921 013	628	1.0	1.0	1901	1.0	1.0
500–1499	102 047	27	3.7 (2.5 to 5.5)	2.1 (1.4 to 3.1)	89	4.1 (3.3 to 5.0)	2.9 (2.4 to 3.7)
1500–2499	521 020	96	2.6 (2.1 to 3.2)	1.6 (1.3 to 2.0)	245	2.2 (1.9 to 2.5)	1.6 (1.4 to 1.8)
>4000	1 207 794	46	0.5 (0.4 to 0.7)	0.8 (0.6 to 1.1)	148	0.6 (0.5 to 0.7)	0.7 (0.6 to 0.8)
Missing	11 592	24	29.1 (19.4 to 43.9)	17.7 (11.5 to 27.2)	14	5.6 (3.3 to 9.5)	4.6 (2.7 to 7.9)

CI = confidence interval; OR = odds ratio.
*Adjusted odds ratios obtained from logistic regression models for homicide/unintentional injury including race, birth weight, alcohol intake, cigarette smoking, prenatal care, marital status, maternal age, maternal education, paternal education, birth order, and interpregnancy interval.

Table 3 Impact of maternal behavior during pregnancy on the risk of injury related infant death

		Homicide			Unintentional injury		
Risk factor	*No of births*	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**
Total	10 671 666	821			2397		
Alcohol intake (drinks/week)							
Non-drinker	7 822 322	596	1.0	1.0	1818	1.0	1.0
1–2	156 894	14	1.2 (0.7 to 2.0)	1.0 (0.6 to 1.7)	46	1.3 (0.9 to 1.7)	1.0 (0.8 to 1.4)
3–4	20 960	3	1.9 (0.6 to 5.8)	0.9 (0.3 to 2.9)	6	1.2 (0.6 to 2.7)	0.6 (0.3 to 1.4)
⩾5	22 754	5	2.9 (1.2 to 7.0)	1.1 (0.5 to 2.7)	17	3.2 (2.0 to 5.2)	1.3 (0.8 to 2.1)
Missing	2 648 736	203	1.0 (0.9 to 1.2)	0.9 (0.6 to 1.2)	510	0.8 (0.8 to 0.9)	0.9 (0.7 to 1.1)
Cigarette smoking (packs/day)							
Non-smoker	6 390 261	416	1.0	1.0	1258	1.0	1.0
½	831 236	122	2.3 (1.8 to 2.8)	1.6 (1.3 to 1.9)	313	1.9 (1.7 to 2.2)	1.3 (1.1 to 1.5)
½–1	494 901	46	1.4 (1.1 to 1.9)	1.2 (0.8 to 1.6)	230	2.4 (2.1 to 2.7)	1.6 (1.4 to 1.9)
>1	87 463	15	2.6 (1.6 to 4.4)	2.1 (1.3 to 3.6)	38	2.2 (1.6 to 3.0)	1.4 (1.0 to 1.9)
Missing	2 867 805	222	1.2 (1.0 to 1.4)	1.3 (0.9 to 1.8)	558	1.0 (0.9 to 1.0)	1.0 (0.9 to 1.3)
Prenatal care							
Adequate	7 079 472	328	1.0	1.0	1095	1.0	1.0
Intermediate	2 334 834	243	2.2 (1.9 to 2.7)	1.3 (1.1 to 1.5)	735	2.0 (1.9 to 2.2)	1.3 (1.2 to 1.5)
Inadequate	850 706	176	4.5 (3.7 to 5.4)	1.8 (1.4 to 2.2)	433	3.3 (2.9 to 3.7)	1.5 (1.3 to 1.7)
Missing	406 654	74	3.9 (3.1 to 5.1)	1.8 (1.4 to 2.4)	134	2.1 (1.8 to 2.6)	1.4 (1.2 to 1.7)

CI = confidence interval; OR = odds ratio.
*Adjusted odds ratios obtained from logistic regression models for homicide/unintentional injury including race, birth weight, alcohol intake, cigarette smoking, prenatal care, marital status, maternal age, maternal education, paternal education, birth order, and interpregnancy interval.

Table 4 Impact of parental factors on the risk of injury related infant death

		Homicide			Unintentional injury		
Risk factor	*No of births*	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**
Total	10 671 666	821			2397		
Marital status							
Married	7 688 857	304	1.0	1.0	1221	1.0	1.0
Unmarried	2 982 809	517	4.4 (3.8 to 5.1)	1.8 (1.5 to 2.2)	1176	2.5 (2.3 to 2.7)	1.3 (1.1 to 1.4)
Maternal age (years)							
20–34	8 355 224	540	1.0	1.0	1711	1.0	1.0
<20	1 397 101	261	2.9 (2.5 to 3.4)	1.5 (1.2 to 1.8)	582	2.0 (1.9 to 2.2)	1.6 (1.4 to 1.8)
>34	919 341	20	0.3 (0.2 to 0.5)	0.5 (0.3 to 0.8)	104	0.6 (0.5 to 0.7)	0.6 (0.5 to 0.7)
Maternal education							
High school	3 874 510	312	1.0	1.0	870	1.0	1.0
<12 years	2 306 881	327	1.8 (1.5 to 2.1)	1.1 (0.9 to 1.3)	971	1.9 (1.7 to 2.1)	1.2 (1.1 to 1.4)
>12 years	3 826 780	114	0.4 (0.3 to 0.5)	0.8 (0.6 to 1.0)	417	0.5 (0.4 to 0.5)	0.8 (0.7 to 0.9)
Missing	663 495	68	1.3 (1.0 to 1.7)	1.1 (0.8 to 1.5)	139	0.9 (0.8 to 1.1)	0.9 (0.7 to 1.1)
Paternal education							
High school	3 347 272	248	1.0	1.0	676	1.0	1.0
<12 years	1 480 721	107	1.0 (0.8 to 1.2)	0.7 (0.6 to 1.0)	469	1.6 (1.4 to 1.8)	1.2 (1.1 to 1.4)
>12 years	3 550 359	73	0.3 (0.2 to 0.4)	0.5 (0.4 to 0.6)	360	0.5 (0.4 to 0.6)	0.8 (0.7 to 0.9)
Missing	2 293 314	393	2.3 (2.0 to 2.7)	1.0 (0.8 to 1.3)	892	1.9 (1.7 to 2.1)	1.3 (1.1 to 1.4)

CI =confidence interval; OR = odds ratio.
*Adjusted odds ratios obtained from logistic regression models for homicide/unintentional injury including race, birth weight, alcohol intake, cigarette smoking, prenatal care, marital status, maternal age, maternal education, paternal education, birth order, and interpregnancy interval.

Table 5 Impact of maternal reproductive history on the risk of injury related infant death

		Homicide			Unintentional injury		
Risk factor	*No of births*	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**	*No of deaths*	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)**
Total	10 671 666	821			2397		
Birth order							
2nd–3rd child	5 117 315	375	1.0	1.0	1264	1.0	1.0
1st child	4 389 961	317	1.0 (0.8 to 1.1)	1.1 (0.9 to 1.3)	667	0.6 (0.6 to 0.7)	0.6 (0.5 to 0.6)
>3rd child	1 120 669	115	1.2 (1.0 to 1.5)	0.9 (0.7 to 1.1)	453	1.7 (1.5 to 1.8)	1.4 (1.2 to 1.5)
Missing	43 721	14	3.4 (2.0 to 6.0)	2.0 (1.1 to 3.8)	13	0.7 (0.4 to 1.3)	0.7 (0.4 to 1.3)
Interpregnancy interval							
>12 months	8 993 937	544	1.0	1.0	1670	1.0	1.0
<6 months	453 804	125	4.6 (3.8 to 5.5)	3.0 (2.4 to 3.8)	292	3.5 (3.1 to 3.9)	1.7 (1.5 to 2.0)
6–12 months	798 665	91	1.9 (1.5 to 2.4)	1.7 (1.3 to 2.2)	315	2.1 (1.9 to 2.4)	1.4 (1.2 to 1.6)
Missing	425 260	61	2.4 (1.8 to 3.1)	1.4 (1.0 to 2.0)	120	1.5 (1.3 to 1.8)	1.0 (0.8 to 1.2)

CI = confidence interval; OR = odds ratio.
*Adjusted odds ratios obtained from logistic regression models for homicide/unintentional injury including race, birth weight, alcohol intake, cigarette smoking, prenatal care, marital status, maternal age, maternal education, paternal education, birth order, and interpregnancy interval.

Discussion

Using a dataset of all births in the United States, we found that the effect of race/ethnicity on the incidence of injury related infant death was largely attenuated by adjustment for alcohol intake during pregnancy, birth order, birth weight, interval since last pregnancy, marital status, maternal age, maternal education, paternal education, prenatal care, and smoking during pregnancy. Even after adjustment, however, Native Americans remained at increased risk for homicide and unintentional injuries, and African Americans for homicide, relative to non-Hispanic whites. After controlling for sociodemographic factors, Mexican American infants appeared protected against both types of injury.

In addition, birth weight was a strong independent risk factor for mortality. In particular, very low birthweight babies had the highest risk of both homicide and unintentional injury. Understanding the separate contribution of race/ethnicity and birth weight to injury related infant death may help identify high risk groups and suggest appropriate interventions.

No biologic reason is apparent to suggest why children of different races or ethnic groups would be more or less prone to injury. Differences in rates of injury may be explained by residual confounding due to unmeasured social or cultural factors. For African Americans, the increased risk of homicide was mostly explained by the sociodemographic factors used in the adjustment, and the risk of unintentional injuries was not increased (compared with whites). A study in Atlanta found that the increased risk of domestic homicide in African Americans did not persist after controlling for household crowding.[23] In addition, residing in high crime neighborhoods,[24] access to guns, drug use, and other factors that were not included in the dataset may be more directly linked to homicide than "race"; the assignment of a death as a homicide rather than as an unintentional injury may also vary by race.

Among Hispanic American infants, previous studies provide contradictory evidence about the risk of injury.[3 25–27] One study found an increased risk in a Hispanic population that was described as "primarily Mexican".[25] In our study, and similar to previous findings regarding overall infant mortality,[28] we found no increased risk of homicide or unintentional injuries for Mexican American infants, and, after controlling for sociodemographic factors, we observed that Mexican American ethnicity may have had a protective effect. A previous report of such "resilience" was attributed to a cultural belief in the importance of family and children.[16] Alternatively, death certificate identification of Mexican ethnicity may be variable and under-reported,[29] which could cause a falsely low incidence of fatal injuries. The lack of standard definitions of "Hispanic", "Mexican", or any racial or ethnic classification makes reports of mortality statistics from different sources difficult to compare, but investigation of possibly protective childcare practices among Mexican parents may help to design effective injury prevention strategies for other groups. In addition, development of standard classifications for ethnic groups in the United States will help to identify those truly at risk and to monitor any progress that is achieved.

Key points

- Race or ethnicity as a risk factor for injury related infant death is mostly explained by sociodemographic variables.
- African American infants are at highest risk for homicides.
- Native American infants are at highest risk for unintentional injuries.
- Mexican American infants seem protected against fatal injuries; a closer study of Mexican American families with infants may reveal potential injury prevention interventions.
- As birth weight decreases, the risk of fatal unintentional and intentional injuries increases.

After controlling for 10 sociodemographic factors, Native Americans continued to have an increased risk for both homicide and fatal unintentional injuries. Our results may actually be conservative estimates of the incidence of injury related deaths in Native Americans: a recent study showed that mortality of Native Americans as reported on death certificates was underestimated compared with Indian Health Service records.[30] Our findings are in agreement with previous studies that underscore the high incidence and severity of injuries to Native Americans.[31 32] Since the risk to Native Americans remained raised after adjustment, the sociodemographic factors included in our analysis may not adequately represent living conditions for Native Americans (an understudied group, in general). Previous studies have suggested that alcohol (for which maternal intake during pregnancy may be a poor marker) may be responsible for many intentional and unintentional deaths in Native Americans.[32 33] In our results, information about alcohol intake during pregnancy was missing in 25% of birth certificates, which could explain why this variable did not reach statistical significance. Other investigators have suggested that more driving and lower use of seat belt restraints, in addition to alcohol abuse, may be responsible for the high rates of motor vehicle accidents.[34] Poor access to health care, unsafe housing, and the ready availability of guns to Native Americans, have also been implicated.[1 33]

Birth weight, the most powerful determinant of infant mortality in general,[35] was also a strong independent risk factor. Unlike racial differences, birthweight differences in risk of injury related infant death may be biologically plausible. The low birthweight child is likely to be more frail for the first year of life relative to the normal weight child, and may, therefore, be more likely to die from the same injury that a

larger baby could withstand. In addition, caretakers may be less attached to low birthweight infants, and more likely to inflict intentional injury.[36 37] Since we do not have data on non-fatal injuries, however, we cannot assume that the incidence of injury necessarily varies by birthweight group—only that deaths due to injury are more frequent. The etiology of low birth weight has not been fully elucidated. We do know that many sociodemographic and biologic factors are related to low birth weight[35] and it has been difficult to decrease its incidence with any single intervention.[38] Therefore, it is likely that the same stresses that predispose to lower birth weight are also likely to have contributed to the occurrence of injuries. In addition, having a low birthweight child may also introduce new stresses into a household already at high risk of injuries.

Implications for prevention

Although fatal injuries are often considered preventable deaths, their etiology is a complex web of risk factors involving biology, behaviors, and environment. As a result, the risk factors for injuries are often related to socioeconomic status and difficult to change. Members of families who are poor, stressed, and lack social support are those who may not have adequate supervision of children and resources to prevent injury. By identifying particular sociodemographic variables and studying their effects on risk of injury, we can both identify high risk groups that require specialized services and improve our understanding of the mechanisms of injury upon which we can intervene. Our results show that preventable risk factors need to be identified for African Americans and Native Americans. These results also suggest that injury prevention should be added to the list of special needs of very low and low birthweight babies and efforts should be enhanced both to prevent low birth weight and to understand how and why these babies are at risk. Finally, beyond the death certificate data that is presented herein, more research is needed that examines carefully the clinical details of infant injuries.

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