

across all other sociodemographic subgroups of mothers, differences in breast-feeding rates between the two surveys were not statistically significant. Considering the many comparisons that were made between these two surveys on mothers' characteristics, the finding of a single, statistically significant difference is not surprising and probably warrants little attention.

The principal sources of data on long-term trends in breast-feeding are the National Surveys of Family Growth and the Ross Laboratories Mothers Survey. The similarities in estimates support the usefulness of these surveys for documenting rates of breast-feeding in the United States. □

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ABSTRACT

Death certificates of children less than 8 years of age who were killed between 1979 and 1986 were linked to their Ohio birth certificates and compared with those of Ohio children born in 1983 (controls). Having an unmarried mother increased risk of homicide almost fivefold (odds ratio 4.87). Having a teenage mother, a mother who had not graduated from high-school, and being of Black race or low birthweight each increased the risk by approximately threefold. Increases in the proportion of children born to unmarried mothers may contribute to increases in childhood homicide rates. (*Am J Public Health*. 1991;81:1052-1054)

Risk Factors for Childhood Homicides in Ohio: A Birth Certificate-Based Case-Control Study

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Introduction

Rates of death by homicide in children have increased markedly in the United States and in Ohio in the last 30 years, particularly for children under age 5.¹⁻³ While many of the risks associated with childhood homicide are known,⁴⁻¹¹ we undertook a case-control study of homicides in Ohio children under the age of 8, to identify risk factors and to clarify the associations among those factors.

Methods

Cases were taken from death certificates of child homicide cases (International Classification of Disease, revision 9 [ICD-9] codes E-960 through E-969) from

the years 1979 through 1986, of Ohio residents who were born during those same years. For each case, the birth certificate was sought in the Ohio birth certificate file, matching on last name, first three letters of first name, and date of birth. Con-

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TABLE 1—Characteristics of Ohio Child Homicide Cases, Ages 0 to 7 Years, 1979–1986, and 1983 Ohio Birth Cohort Controls

Characteristic	Case Control	
Born out of wedlock (%)	54.2	19.6
Black race (%)	38.0	15.1
Low birthweight (%)	16.2	6.7
Mother not a high school graduate (%)	47.4	20.8
Pregnancy complications (%)	12.0	9.6
Illness in pregnancy (%)	4.2	3.4
Singleton birth (%)	96.5	97.9
Male (%)	60.6	51.2
Mother's age (mean years)	21.9	25.3

TABLE 2—Odds Ratios (ORs) and Confidence Intervals (CI) for Selected Risk Factors for Child Homicide in Ohio Children, Ages 0 to 7 Years, 1979–1986, Compared with 1983 Ohio Births as Controls

Risk Factor	OR ^a	95% CI ^b
Born out of wedlock	4.87 ^a	3.45–6.89
Black race	3.52 ^a	2.47–5.02
Low birthweight	2.75 ^a	1.71–4.38
Mother not a high-school graduate	3.45 ^a	2.43–4.88
Pregnancy complications	1.32	0.77–2.24
Illness in pregnancy	1.29	0.51–3.02 ^b
Singleton birth	0.57	0.22–1.57 ^b
Labor complications	1.15	0.78–1.68
Metro county resident	1.52 ^a	1.04–2.21
Congenital anomalies	0.55	0.03–3.64 ^b
Teenaged mother	3.20 ^a	2.23–4.60

^a Statistically significant
^b Less than five frequencies per cell

trols, also obtained from Ohio birth certificates, were all children born live to Ohio residents in 1983.

Factors examined in this study included marital status of the victim's mother at the time of the victim's birth, race (Black vs White), educational attainment of the mother (<12 years vs ≥12 years), county type (metropolitan vs non-metropolitan), birthweight (<2500 g vs ≥2500 g), mother's age (teenager or ≥20), presence or absence of birth complications, illness during pregnancy, labor complications, multiple birth, and congenital anomalies.

Odds ratios (ORs) were calculated for each of these potential risk factors. Those risk factors associated with the outcome in a univariate analysis were examined in a stratified analysis, two at a time. Cornfield's method was used to calculate 95% confidence limits around the odds ratios.¹²

Results

There were 189 children who were born and died during the study period; birth certificates were identified for 140, or almost 75%. Of these, 134, or 96%, were under age 5. Mean age at death was 1.1

years. Children for whom birth certificates could not be found were more likely to be Black (48% vs 39% for whom certificates were found), metropolitan residents (78% vs 30%), and/or less than 28 days old at the time of death (29% vs 7%).

Cases were more likely to be Black, male, and of low birthweight than controls (Table 1). Likewise, case mothers were younger at the time of the child's birth and less likely to be married or to have a high school diploma.

Univariate ORs (Table 2) were highest for being born out of wedlock, Black race, having a mother who did not finish

TABLE 3—Crude and Stratified Odds Ratios (ORs) for Homicide, Ohio Cases under 7 Years of Age from 1979 to 1986, Compared with All 1983 Ohio Births

Risk Factor	Out-of-Wedlock Birth	Black	Teenaged Mother	Metro County Residence	High School Nongraduate	Low Birthweight
Crude	4.87 ^a	3.52 ^a	3.20 ^a	1.52 ^a	3.45 ^a	2.75 ^a
Stratified by:						
Legitimacy						
Legitimate	—	1.51	3.24 ^a	0.97	2.41 ^a	2.77 ^a
Out of wedlock	—	1.84 ^a	1.27	1.47	1.82	1.77
Race						
Black	4.29 ^a	—	1.45	2.44	2.88 ^a	2.72 ^a
White	3.84 ^a	—	4.06 ^a	0.98	3.14 ^a	1.70
Mother's age						
<20 years	2.04 ^a	1.48	—	1.28	1.68	0.85
≥20 years	5.19 ^a	4.13 ^a	—	1.65 ^a	3.16 ^a	3.95 ^a
County type						
Metro	5.37 ^a	3.54 ^a	2.96 ^a	—	4.65 ^a	2.77 ^a
Nonmetro	3.54 ^a	1.42 ^a	3.82 ^a	—	1.78	2.16
Mother's education						
Not a high school graduate	4.41 ^a	2.73 ^a	1.58	2.68 ^a	—	1.88
High school graduate	3.33 ^a	2.98 ^a	2.98 ^a	1.03	—	2.70
Birthweight						
Low	3.10 ^a	4.72 ^a	0.84	1.72	2.49	—
Normal	4.86 ^a	2.96 ^a	3.89 ^a	1.34	3.58 ^a	—

^a Lower bound of 95% confidence limit does not include 1.0.

TABLE 4—Homicide Deaths and Out-of-Wedlock Births of Ohio Children by Race and Specific Years

	No. of Homicide Deaths under Age 5 Years	Homicide Rate per 100 000 Deaths under Age 5 Years	All Ohioans born to unwed Mothers (%)
White			
1970	17	2.1	5.8
1980	19	2.8	11.0
1986	12	1.7	15.7
Black			
1970	7	7.2	38.3
1980	9	9.3	56.8
1986	20	19.9	64.0

high school, having a teenaged mother, having a birthweight less than 2500 g, and living in a metropolitan county.

The effect of having an unmarried mother on risk of homicide was strong in all subgroups examined (Table 3), but was greatest among children whose mothers were age 20 or older, and/or lived in a metropolitan area, and among children who were of normal birthweight.

The crude risk of homicide associated with Black race was 3.52 (Table 3), but the risk fell to between 1.5 and 1.8 when separate strata of children born to married and unmarried mothers were examined. Thus, the apparent effect of Black race on risk of homicide is largely explained by the fact that a larger proportion of Black infants were born to unmarried mothers. The effect of Black race on risk of homicide is greatest in children residing in metro counties, in low-birthweight children, and in children with mothers over age 20, and varies little by educational status of the mother.

The crude risk of dying from homicide is increased approximately 3.2-fold when the child's mother is a teenager at the time of the child's birth. The magnitude of this increase in risk is greatest when the child is otherwise at lower risk.

The crude OR for metropolitan residence is only of modest magnitude (1.52), but the increase in risk is much greater when the mother is not a high school graduate or when the mother is Black.

Children born to mothers who did not finish high school (a proxy for low socioeconomic status¹³⁻¹⁵) are approximately 3.45 times more likely to become homicide victims than are children born to high school graduates. This OR estimate appears to be confounded in part by effects of race, mother's age, and marital status, as the stratum-specific estimates for both

strata of all three variables were noticeably less than the crude OR.

Low birthweight was a significant risk factor for homicide in most subgroups. Low birthweight is more strongly associated with risk of homicide among Black than White infants, and among children whose mothers were married and age 20 or older at the time of their child's birth.

Discussion

Many of the expected relationships found in other studies were observed in these data: children of younger, poorly educated mothers, Black children, children of low birthweight, children whose mothers were unmarried at the time of the child's birth, and children who resided in metropolitan areas were all more likely to be killed than other children. In general, these variables appear to be independently associated with the risk of homicide. Variables associated with the pregnancy were not good predictors for risk of homicide, nor were congenital malformations. The effect of race is largely explained by the high prevalence of Black infants with unmarried mothers. Similarly, the crude effect of low educational attainment of the mother on risk of homicide appears to be explained in part by the fact that these mothers are more likely to be unmarried. A weaker effect of having an unmarried or teenaged mother on risk of homicide was seen when the infant was otherwise at lower risk. This suggests that other social supports in the child's environment may reduce the risk of homicide.

The consistent association of homicide risk with being born to an unmarried mother is striking in these data. It is unclear whether this finding represents a causal relationship, or whether both increased risk of homicide and being born to an unmarried mother are consequences of some other risk factor that was not captured in

our study. If there is a causal relationship, we can expect the incidence of childhood homicide to continue to increase, because the percentage of Ohio children born to unmarried mothers has increased dramatically in recent years (Table 4).

Children have many health and social problems, which makes the causes of childhood homicide complex. However, interventions to help teenagers finish high school, begin careers, and find permanent life partners before becoming parents would probably help prevent childhood homicide and abuse.¹⁶ Such interventions are, in any case, desirable for other reasons. The strong associations between having a young or unmarried mother and the risk of homicide suggest that interventions to prevent homicides in children should focus on these social variables. □

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