NCPH
North Carolina Public Health
SCHS Studies
A Special Report Series by the State Center for Health Statistics
P.O. Box 29538, Raleigh, N.C. 27626-0538
www.schs.state.nc.us/SCHS/

No. 105 May 1997

Racial Differences in Risk Factors for Sudden Infant Death Syndrome: A Case-Control Study in North Carolina

by

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ABSTRACT

In both North Carolina and the United States, Sudden Infant Death Syndrome (SIDS) occurs at an elevated rate among black infants compared to white infants. Relatively little is known about the causes of this racial disparity. Accordingly, the present study explores the extent to which a range of previously-identified risk factors may underlie racial differences in SIDS rates.

To investigate these issues, a case-control study was conducted using vital statistics data for the 1990-1994 North Carolina birth cohorts. Chi-square and logistic regression analyses were used to examine differences in the prevalence and predictiveness of various maternal, prenatal, and perinatal risk factors among SIDS cases and controls for each racial group.

Results demonstrated that the heightened risk of SIDS for black infants disappears after adjustment for all measured risk factors. This suggests that the elevated SIDS rate among blacks relative to whites is due primarily to higher incidence of the risk factors in this minority group. Maternal smoking during pregnancy, low birth weight, inadequate prenatal care, and low maternal education were associated significantly with SIDS for both races, suggesting that each of these risk factors independently contributes to the risk of SIDS among blacks as well as whites.

The results are discussed in terms of populations subgroups towards which interventions for SIDS should be targeted.

INTRODUCTION

Sudden Infant Death Syndrome (SIDS) is a serious public health concern as well as a pressing scientific problem. Its high public health and scientific priority stems from the fact that SIDS is a major contributor to infant mortality. In the United States and many other industrialized countries, SIDS is the most common cause of death for infants between 1 week and 1 year of age, and accounts for over one third of all postneonatal deaths (Wegman, 1991). In 1994, 1 out of every 970 U.S. infants died of this condition (National Center for Health Statistics, 1996). In fact, more infants die of SIDS in a year than of cancer, heart disease, pneumonia, child abuse, AIDS, cystic fibrosis, and muscular dystrophy combined. Until 1988, the rate of SIDS had changed little in the U.S. However, since then SIDS mortality has declined 26.5 percent from a rate of 1.40 to 1.03 per 1,000 live births in 1994 (National Center for Health Statistics, 1996). This reduction represents a saving of over 1,500 infant lives a year. Paralleling the national trend, mortality from SIDS in North Carolina has decreased in recent years. From 1988 to 1994, the rate of SIDS declined 36.8 percent, from a rate of 1.82 to 1.15 per 1,000 live births. Although this decline is greater than that of the U.S., the SIDS rate in North Carolina remains slightly higher than the national rate.

This drop in the occurrence of SIDS has been attributed, to a large extent, to a national public health campaign that recommends that healthy infants be put to sleep on their backs or sides to reduce the risk of SIDS (American Academy of Pediatrics, 1992). At the national level, such advice has decreased the percentage of babies being placed on their stomach to sleep from over 70 percent in 1992 to less than 30 percent in 1995 (National Institute of Child Health and Human Development, 1996). In contrast, the most current data available for North Carolina indicate that, in 1994, only 56 percent of babies in the state were being placed to sleep in the recommended position (North Carolina Birth Cohort Survey, 1996).

Despite the overall reduction in the incidence of SIDS, this trend has not been uniform among racial groups – SIDS rates remain considerably higher for black versus white infants. For example, in 1994, the SIDS mortality rate in the U.S. for black infants (1.94) was 2.3 times that for white infants (.85). Preliminary 1995 data suggest that the black/white gap may be widening, standing at the highest level since 1983 (Centers for Disease Control, 1996).

This racial disparity is also apparent in North Carolina, although the difference between black and white SIDS rates is not as great as that of the nation. For example, the SIDS mortality rate in 1994 for North Carolina black infants (1.47) was only 1.4 times greater than the rate for white infants (1.04). This pattern is due to the fact that the North Carolina white rate is considerably higher than that of the nation, whereas the state-level black rate is somewhat lower than that of the U.S.

While these racial disparities exist, relatively little research has addressed directly the associations between race and SIDS. While race has been identified repeatedly as a risk factor for SIDS (Black, David, Brouillette, & Hunt, 1985; Hayward & Madison, 1990; Li & Daling, 1991; Little & Peterson, 1990), the underlying factors that mediate racial differences remain unclear. Some investigators have attempted to account for racial differences in SIDS rates by controlling for socioeconomic factors, but such adjustments do not eliminate entirely the racial disparities in SIDS mortality (see Hoffman & Hillman, 1992). Thus, the relationship between SIDS and race seems to be more than just a matter of differences in family income and education.

Why are black infants more likely to die from SIDS compared to white infants? Although there are probably various answers to this question, one way to begin to explore this issue is to examine how risk factors for SIDS vary according to race. Earlier epidemiologic research has established a range of medical and behavioral variables that are associated with an increased risk of SIDS. These risk factors include cigarette smoking during pregnancy, young maternal age, unmarried marital status, low maternal weight gain during pregnancy, low maternal education, failure to obtain regular prenatal medical care, low socioeconomic status, low birth weight, low Apgar score, and male gender (for a review, see Hoffman & Hillman, 1992). Thus, one explanation for the racial disparity in SIDS mortality rates may be that black infants have a disproportionately higher number of risk factors for this condition compared to white infants. A second possibility for these differential SIDS rates may be that one race relative to the other has different or stronger factors that indicate risk.

The present study explores the differences in the prevalence of the above described risk factors between black and whites in an effort to identify the strongest predictors of SIDS for each racial group. Although such risk factors in and of themselves do not cause SIDS, they are important to examine because they may provide insight into the source of racial disparities in SIDS, as well as offer clues to the underlying causes of such deaths.

METHODS

This investigation made use of computer-matched live birth and infant death certificate files for North Carolina residents born between 1990 to 1994. These files were linked to computer-based Medicaid claims files using the infant's name, date of birth, hospital of birth, and other information. Infants were identified as SIDS cases if SIDS was listed as the underlying cause of death on the death certificate (based on the Ninth Revision, International Classification of Disease code 798.0).

The study population consisted of 68 percent white births and 29 percent black births, with the 3 percent of deliveries to other races excluded. Among white infants, there were 376 SIDS deaths and 350,216 live births during this period, resulting in a rate of 1.1 per 1,000 live births. In contrast, the SIDS rate for black infants was higher, with 256 deaths and 148,805 live births, resulting in a rate of 1.7 per 1,000 live births. Note that these SIDS death rates differ slightly from those published in the standard North Carolina vital statistics reports because the data in the current study are based on the infant's year of birth rather than the year of death.

In order to examine racial differences in the prevalence and predictiveness of risk factors associated with SIDS, analyses were performed for black and white infants using identical predictor variables. These predictor variables included: cigarette smoking during pregnancy; maternal age less than 18 or maternal age greater than 34; unmarried marital status; maternal weight gain during pregnancy less than 15 pounds; maternal education less than 12 years; prenatal care began after the first trimester or no prenatal care; infant birth weight less than 2,500 grams; 5-minute Apgar score less than 8; male gender; and low socioeconomic status.

Data regarding each of these risk factors (except for socioeconomic status) were obtained from the birth certificate. Because birth certificate data do not provide a direct indicator socioeconomic status, Medicaid eligibility was used as a proxy measure of socioeconomic status. Mothers were subdivided into three groups on the basis of their Medicaid enrollment status: non-Medicaid mothers, recipients of Aid to Families with Dependent Children (AFDC; eligibility is set at 45% of the poverty level), and recipients of Medicaid for Pregnant Women (MPW; eligibility is set at 185% of the poverty level).

First, to examine racial differences in the prevalence of these risk factors, the percentage of all black and white live births with each factor was determined. Chi-square procedures were used to test for differences in these percentages between black and white infants.

Next, to determine whether a relationship exists between these risk factors and the incidence of SIDS, the percentage of infants having each risk factor was compared among those who died of SIDS and those who survived the first year of life. For efficiency, a 5 percent random sample of white infants who survived the first year of life (n=16,981) and a 5 percent random sample of black survivors (n=7,267) were selected from the 1990-1994 North Carolina birth cohort to serve as controls. Differences in the prevalence of risk factors among cases and controls were tested separately for each racial group using chi-square analyses.

In the final stage of analysis, separate logistic regression analyses were performed for both races combined and for each race, to examine the strength of the association between each risk factor and SIDS. More specifically, odds ratios and 95 percent confidence intervals were estimated to determine the effects of each factor on the risk of SIDS before and after adjusting for all other risk factors included in this investigation.

In brief, each odds ratio represents an estimate of the relative risk of SIDS mortality for infants who have a particular risk factor compared to the risk among those who do not have that risk factor. As such, an odds ratio greater than one indicates an increased risk of dying of SIDS for those infants who have that factor. The unadjusted odds ratios do not account for the potential influence of the other risk factors, whereas the adjusted

odds ratios are considered to be estimates of the independent or separate effect of each risk factor, since each is adjusted for the presence of the other risk factors that are included in the regression models. Thus, the unadjusted and adjusted odds ratios can be compared to determine the extent to which the other variables in this investigation affect the relationship between SIDS and a particular risk factor.

RESULTS

To examine the extent to which the prevalence of risk factors for SIDS varies according to race, the number and percentage of black and white births having each risk factor was calculated. The prevalence of the majority of risk factors associated with SIDS was higher among black infants than among white infants. As can be seen in Table 1, black infants were more likely than white infants to have mothers under 18 years of age, mothers who were not married, mothers who gained less than 15 pounds during pregnancy, mothers who did not finish high school, mothers who received either no or late prenatal care, and mothers who were enrolled in Medicaid. In addition, black infants were more likely than white infants to be low birth weight and to have a low 5-minute Apgar Score. In contrast, white infants were more likely than black infants to be male or to have mothers who smoked cigarettes during pregnancy. Due in part to the large number of observations, all chi-square tests for racial differences in each risk factor category were significant at $p < .001$.

Next, to examine whether these risk factors are associated with SIDS, the percentage of infants having each risk factor was compared for those who died of SIDS and for those who survived the first year of life. For white infants, the characteristics of SIDS cases and controls are shown in Table 2, whereas these data for black infants are summarized in Table 3. These tables show that the percentage of SIDS cases having each risk factor was greater than the percentage of controls having each risk factor. Specifically, for both races, all chi-square tests for each risk factor category by group (i.e., case versus control) were significant at $p < .05$, with the exception of male gender and low Apgar score for black infants.

To estimate the strength of the relationship between each risk factor and SIDS, logistic regression was used to compute unadjusted and adjusted odds ratios and 95 percent confidence intervals for SIDS as a function of each risk factor. These data are presented for the entire sample in Table 4. As can be seen, before adjusting for other risk factors, all of the variables that were examined were associated with SIDS. However, when all other risk factors were controlled, low maternal age, unmarried marital status, and low Apgar score were not related to SIDS death. Moreover, this analysis shows that when all other risk factors are accounted for, the risk of SIDS among blacks was not significantly higher that than of whites. In contrast, maternal smoking, low maternal weight gain, low maternal education, late prenatal care, AFDC Medicaid status, low birth weight, and male gender remained significant after adjustment.

Tables 5 and 6 show the results of the same analysis stratified by race. As can be seen, before controlling for other risk factors, the variables associated with a higher risk of SIDS were quite similar for both races. For white infants, all of the variables examined were related significantly to SIDS. Similarly, for black infants, all of the factors were associated with SIDS, with the exception of male gender and low Apgar score. Nonetheless, it is important to note that each of the risk factors was more strongly associated with SIDS among whites than among blacks. Moreover, the strongest predictors of SIDS differed, at least to some extent, between the races. For example, for white infants, the factor most strongly related to SIDS was low birth weight, having an odds ratio greater than 5, whereas for blacks, the strongest predictor of SIDS was maternal smoking, having a relatively lower odds ratio of 2.4.

After adjusting for other risk factors, the risk profiles of black and whites differed to an even greater extent than before adjustment. As summarized in Table 5, for white infants, low birth weight, maternal smoking, low maternal education, late prenatal care, low maternal weight gain, young maternal age, and male gender were associated with a higher incidence of SIDS. In contrast, for blacks, only four factors involved a greater risk of SIDS when all other risk factors were simultaneously controlled. As can be seen in Table 6, these were: low

Table 1
Prevalence of SIDS Risk Factors Among Black and White Live Births from the 1990-1994 North Carolina Birth Cohort

	White Infants		Black Infants	
	Number	**Percentage**	**Number**	**Percentage**
Maternal Smoking				
Yes	70,002	20.4	20,260	14.3
No	272,688	79.6	121,323	85.7
Maternal Age				
<18 Years	13,833	4.0	15,220	10.8
18-34 Years	299,660	87.4	118,652	83.8
>34 Years	29,197	8.5	7,711	5.5
Marital Status				
Not Married	54,071	15.8	93,515	66.0
Married	288,619	84.2	48,068	34.0
Maternal Weight Gain				
<15 Pounds	22,560	6.6	19,082	13.5
≥15 Pounds	320,130	93.4	122,501	86.5
Maternal Education				
<12 Years	64,259	18.8	39,381	27.8
≥12 Years	278,431	81.3	102,202	72.2
Month Prenatal Care Began				
No Prenatal Care	1,700	0.5	3,198	2.3
Early (month 1-3)	294,287	85.9	91,984	65.0
Late (month 4-9)	46,703	13.6	46,401	32.8
Medicaid Status				
Non-Medicaid	254,801	72.8	58,888	39.6
AFDC	27,486	7.9	62,266	41.9
MPW	67,293	19.4	27,645	18.6
Birthweight of Newborn				
<2500 grams	21,435	6.3	17,856	12.6
≥2500 grams	321,255	93.8	123,727	87.4
Apgar Score (5 min.)				
Low (<8)	8,644	2.5	6,561	4.6
Normal (8-10)	334,046	97.5	135,022	95.4
Gender of Newborn				
Male	176,125	51.4	71,790	50.7
Female	166,565	48.6	69,793	49.3

Table 2
The Prevalence of Risk Factors Among SIDS Deaths versus Controls for White Infants in North Carolina, 1990-1994

	SIDS Deaths		Controls	
	Number	**Percentage**	**Number**	**Percentage**
Maternal Smoking				
Yes	173	47.8	3,480	20.4
No	189	52.2	13,584	79.6
Maternal Age				
<18 Years	43	11.8	660	3.9
18-34 Years	301	82.9	14,977	87.7
>34 Years	19	5.2	1,450	8.5
Marital Status				
Not Married	114	31.4	2,683	15.7
Married	249	68.6	14,409	84.3
Maternal Weight Gain				
<15 Pounds	57	15.7	1,396	8.2
≥15 Pounds	306	84.3	15,703	91.8
Maternal Education				
<12 Years	160	44.2	3,131	18.3
≥12 Years	202	55.8	13,956	81.7
Month Prenatal Care Began				
No Prenatal Care	6	1.7	138	0.8
Early (month 1-3)	256	70.5	14,625	85.8
Late (month 4-9)	101	27.8	2,286	13.4
Medicaid Status				
Non-Medicaid	191	52.6	12,491	73.1
AFDC	66	18.2	1,280	7.5
MPW	106	29.2	3,328	19.5
Birthweight of Newborn				
<2500 grams	91	25.1	1,030	6.0
≥2500 grams	272	74.9	16,067	94.0
Apgar Score (5 min.)				
Low (<8)	18	5.0	367	2.2
Normal (8-10)	341	95.0	16,655	97.8
Gender of Newborn				
Male	242	66.7	8,843	51.7
Female	121	33.3	8,255	48.3

Table 3
The Prevalence of Risk Factors Among SIDS Deaths versus Controls for Black Infants in North Carolina, 1990-1994

	SIDS Deaths		Controls	
	Number	**Percentage**	**Number**	**Percentage**
Maternal Smoking				
Yes	70	29.3	1,044	14.7
No	169	70.7	6,043	85.3
Maternal Age				
<18 Years	36	15.1	750	10.6
18-34 Years	195	81.6	5,979	84.2
>34 Years	8	3.3	370	5.2
Marital Status				
Not Married	188	78.3	4,680	65.9
Married	52	21.7	2,423	34.1
Maternal Weight Gain				
<15 Pounds	60	25.0	1,185	16.7
≥15 Pounds	180	75.0	5,922	83.3
Maternal Education				
<12 Years	107	44.8	1,963	27.7
≥12 Years	132	55.2	5,131	72.3
Month Prenatal Care Began				
No Prenatal Care	7	2.9	220	3.1
Early (month 1-3)	120	50.4	4,543	64.2
Late (month 4-9)	111	46.6	2,314	32.7
Medicaid Status				
Non-Medicaid	70	29.2	2,795	39.3
AFDC	135	56.3	2,995	42.1
MPW	35	14.6	1,317	18.5
Birthweight of Newborn				
<2500 grams	57	23.8	855	12.0
≥2500 grams	183	76.3	6,249	88.0
Apgar Score (5 min.)				
Low (<8)	15	6.3	285	4.0
Normal (8-10)	222	93.7	6,765	96.0
Gender of Newborn				
Male	133	55.4	3,687	51.9
Female	107	44.6	3,420	48.1

Table 4
Unadjusted and Adjusted Odds Ratios for SIDS and 95 Percent Confidence Intervals (CI) for Black and White Infants in North Carolina, 1990-1994

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Race		
Black	1.59 (1.35-1.88)	1.06 (0.86-1.31)
White	1.00	1.00
Maternal Smoking		
Yes	2.95 (2.49-3.48)	2.18 (1.81-2.61)
No	1.00	1.00
Maternal Age		
<18 Years	2.44 (1.91-3.11)	1.30 (0.97-1.74)
18-34 Years	1.00	1.00
>34 Years	0.58 (0.39-0.85)	0.74 (0.49-1.11)
Marital Status		
Not Married	2.29 (1.95-2.70)	1.18 (0.94-1.47)
Married	1.00	1.00
Maternal Weight Gain		
<15 Pounds	2.02 (1.64-2.48)	1.44 (1.15-1.80)
≥15 Pounds	1.00	1.00
Maternal Education		
<12 Years	3.00 (2.54-3.53)	1.76 (1.44-2.15)
≥12 Years	1.00	1.00
Month Prenatal Care Began		
No Prenatal Care	1.47 (0.84-2.57)	0.65 (0.34-1.22)
Early (month 1-3)	1.00	1.00
Late (month 4-9)	2.31 (1.95-2.74)	1.51 (1.26-1.83)
Medicaid Status		
Non-Medicaid	1.00	1.00
AFDC	2.33 (1.96-2.77)	1.32 (1.03-1.69)
MPW	1.28 (1.06-1.56)	1.05 (0.84-1.32)
Birthweight of Newborn		
<2500 grams	3.85 (3.18-4.66)	2.84 (2.30-3.50)
≥2500 grams	1.00	1.00
Apgar Score (5 min.)		
Low (<8)	2.11 (1.47-3.02)	1.23 (0.84-1.80)
Normal (8-10)	1.00	1.00
Gender of Newborn		
Male	1.53 (1.30-1.81)	1.59 (1.34-1.89)
Female	1.00	1.00

Table 5
Unadjusted and Adjusted Odds Ratios for SIDS and 95 Percent Confidence Intervals (CI) for White Infants in North Carolina, 1990-1994

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Maternal Smoking		
Yes	3.57 (2.90-4.41)	2.26 (1.80-2.85)
No	1.00	1.00
Maternal Age		
<18 Years	3.35 (2.41-4.64)	1.52 (1.03-2.24)
18-34 Years	1.00	1.00
>34 Years	0.59 (0.37-0.95)	0.79 (0.49-1.30)
Marital Status		
Not Married	2.46 (1.96-3.08)	1.14 (0.86-1.51)
Married	1.00	1.00
Maternal Weight Gain		
<15 Pounds	2.10 (1.57-2.80)	1.57 (1.16-2.14)
≥15 Pounds	1.00	1.00
Maternal Education		
<12 Years	3.53 (2.86-4.36)	1.86 (1.43-2.42)
≥12 Years	1.00	1.00
Month Prenatal Care Began		
No Prenatal Care	2.06 (0.90-4.70)	0.63 (0.24-1.65)
Early (month 1-3)	1.00	1.00
Late (month 4-9)	2.49 (1.97-3.15)	1.50 (1.16-1.94)
Medicaid Status		
Non-Medicaid	1.00	1.00
AFDC	2.75 (2.09-3.61)	1.37 (0.96-1.95)
MPW	1.71 (1.36-2.15)	1.11 (0.84-1.46)
Birthweight of Newborn		
<2500 grams	5.22 (4.08-6.67)	3.78 (2.89-4.94)
≥2500 grams	1.00	1.00
Apgar Score (5 min.)		
Low (<8)	2.40 (1.48-3.89)	1.28 (0.76-2.15)
Normal (8-10)	1.00	1.00
Gender of Newborn		
Male	1.87 (1.50-2.33)	1.94 (1.55-2.43)
Female	1.00	1.00

Table 6
Unadjusted and Adjusted Odds Ratios for SIDS and 95 Percent Confidence Intervals (CI) for Black Infants in North Carolina, 1990-1994

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Maternal Smoking		
Yes	2.40 (1.80-3.19)	1.91 (1.40-2.61)
No	1.00	1.00
Maternal Age		
<18 Years	1.50 (1.05-2.16)	1.09 (0.70-1.69)
18-34 Years	1.00	1.00
>34 Years	0.63 (0.31-1.28)	0.69 (0.33-1.43)
Marital Status		
Not Married	1.87 (1.37-2.56)	1.22 (0.84-1.75)
Married	1.00	1.00
Maternal Weight Gain		
<15 Pounds	1.67 (1.24-2.25)	1.36 (0.99-1.86)
≥15 Pounds	1.00	1.00
Maternal Education		
<12 Years	2.12 (1.63-2.75)	1.58 (1.15-2.18)
≥12 Years	1.00	1.00
Month Prenatal Care Began		
No Prenatal Care	0.94 (0.44-2.03)	0.64 (0.27-1.50)
Early (month 1-3)	1.00	1.00
Late (month 4-9)	1.80 (1.39-2.33)	1.49 (1.13-1.96)
Medicaid Category		
Non-Medicaid	1.00	1.00
AFDC	1.77 (1.36-2.29)	1.21 (0.86-1.71)
MPW	0.75 (0.52-1.08)	0.82 (0.53-1.27)
Birthweight of Newborn		
<2500 grams	2.28 (1.68-3.09)	1.94 (1.39-2.70)
≥2500 grams	1.00	1.00
Apgar Score (5 min.)		
Low (<8)	1.60 (0.94-2.74)	1.22 (0.70-2.14)
Normal (8-10)	1.00	1.00
Gender of Newborn		
Male	1.15 (0.89-1.49)	1.20 (0.92-1.56)
Female	1.00	1.00

birth weight, maternal smoking, low maternal education, and late prenatal care. Thus, whites, but not blacks, showed an increased risk of SIDS associated with low maternal weight gain, young maternal age, and male gender. Despite these differences between the races, the two strongest predictors of SIDS were the same for blacks and for whites: low birth weight and maternal smoking (although each of these factors were associated with a higher risk for SIDS among whites than among blacks). Also note that, except for gender, each of the adjusted odds ratios was substantially lower after controlling for other factors, suggesting that some of these risk factors are related.

DISCUSSION

Consistent with earlier epidemiologic research (Black et al., 1985; Hayward & Madison, 1990; Li & Daling, 1991; Little & Peterson, 1990), the data presented here demonstrate a greater risk of SIDS among black infants compared to white infants. However, when all other risk factors are controlled, the associations of race with SIDS disappear, suggesting that the elevated SIDS rates among blacks relative to whites is due primarily to the higher incidence of the measured risk factors in this minority group. Importantly, these findings indicate that race acts in a secondary manner (i.e., explained by other factors), rather than as a primary or causal agent. Nonetheless, the effects of race on SIDS appear to be more complicated than that obtained by simply controlling for risk factors in a statistical model. Consider the following example: low birth weight is a major risk factor for SIDS, and the percentage of low birth weight infants among blacks is twice that of whites. However, the adjusted risk of black low birth weight infants dying of SIDS is considerably less than that of low birth weight white infants. Clearly, this example illustrates that there are important intervening factors, not available using vital statistics data, that must be taken into account. For example, racial differences in factors relating to social conditions, environmental stress, or infant care practices (including sleeping position), might mediate the effects of birth weight and other risk factors on the occurrence of SIDS.

The present findings also indicate that, in general, blacks have a greater burden of risk factors for SIDS than whites. As noted above, the elevated rate of SIDS among black compared to white infants is due, to a large extent, to the higher incidence of risk factors in this minority group. Nonetheless, this over-representation of blacks in some of the risk groups does not contribute significantly to the racial disparity in SIDS. For example, blacks have higher rates of teenage births, higher rates of births to unmarried women, higher rates of inadequate weight gain during pregnancy, and lower family income (as measured by Medicaid category) than whites. However, when all other risk factors are controlled, none of these four variables are associated with a significantly increased risk of SIDS among blacks, suggesting that the higher prevalence of these variables among blacks does not contribute substantially to the racial gap in SIDS.

Several risk factors were found to be associated with SIDS for both blacks and whites. For example, after controlling for all measured risk factors, maternal smoking and low birth weight were the greatest risk factors for SIDS for both races. In addition to their independent effects on SIDS, these two factors are interrelated, as numerous studies have shown that cigarette smoking during pregnancy is a major contributor to low birth weight (e.g., Kramer, 1987). Thus, prenatal care services should include assistance with smoking cessation. Besides reducing the direct effects of smoking on SIDS mortality, such efforts may also decrease the occurrence of SIDS by reducing the number of low birth weight infants. Also, programs targeted at reducing the incidence of low birth weight, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), may serve to reduce the incidence of SIDS.

Additionally, after controlling for all other factors, having less than a high school education and having begun prenatal care late were related to the rate of SIDS for both races. These findings suggest that early interventions targeted towards mothers who have not finished high school may be beneficial to blacks as well as whites. In addition, improving access to and utilization of prenatal care services may contribute to a reduction in SIDS for both races. This may be a particularly important issue for black mothers, as a recent national survey (The Commonwealth Fund, 1995) has shown that blacks have greater difficulties compared to whites in obtaining appropriate and needed health care.

Conclusions and Implications

The results of this study have identified some specific risk factors and population subgroups towards which interventions for SIDS should be targeted. In particular, these data suggest that prevention strategies to reduce smoking during pregnancy and low birth weight, in addition to their other benefits, would lead to a reduction in the incidence of SIDS among both races. Such early interventions seem to be especially important for mothers who have not graduated from high school. Further, ensuring access to and utilization of early prenatal care services might serve to decrease the occurrence of SIDS among blacks as well as whites.

Importantly, this investigation has shown that race, in and of itself, is not related to SIDS. Rather, other factors associated with race mediate the observed differences between blacks and whites. That is, the heightened risk of SIDS among blacks compared to whites can be explained by statistically adjusting for the risk factors examined in this analysis. Nonetheless, it is clear that there are additional unidentified factors (i.e., effect modifiers) that also contribute to the increased risk among blacks. Consequently, these data suggest that race, per se, should not be used as a criterion for assessing the need for early interventions related to SIDS. Rather, prevention efforts should be directed at women and infants of both races who have one or more of the above mentioned risks.

This analysis of risk factors offers important clues as to the underlying causes of SIDS. The increased risk associated with maternal factors such as late prenatal care, low weight gain, and smoking suggests that the prenatal environment of SIDS infants may be less than optimal. Further, because the percentage of Medicaid-enrolled mothers and the percentage of mothers without a high school education was greater for SIDS cases compared to control infants, the postnatal environment of SIDS infants may also be less than optimal as the result of financial stresses associated with lower socioeconomic status (see Conger, et al., 1992). Moreover, the higher incidence of low birth weight deliveries and low Apgar scores suggests that the perinatal health of SIDS newborns is poorer than that of control infants. Further epidemiological research is needed in order to understand the complex relationships between these variables and other factors associated with race that affect infant health and serve to heighten the risk of SIDS.

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GLOSSARY

Chi-Square – A statistic that is used to test for the significance of a difference between the frequencies (i.e., counts) of a categorical variable in two or more groups. This test compares the frequency that would be expected, if chance only were operating, with the frequency that actually occurred.

Confidence Interval – A confidence interval is a range of values that has a specified probability of containing the true value of the variable (e.g., mean or proportion) that is being estimated. For example, the 95% confidence would consist of an interval such that there is a 95% probability that the true value of the variable that is being estimated will fall within that interval.

Logistic Regression – Logistic regression develops a model that estimates the probability of an event of interest occurring in the population from which the data under analysis have been sampled. The effect of each independent variables is expressed in term of an odds ratio.

Odds ratio – An odds ratio greater than one indicates an increased risk of an event of interest occurring (e.g., dying of SIDS) for those people who fall into a certain category of a particular variable (e.g., low birthweight) relative to those who do not fall into that category (e.g., normal birthweight). An unadjusted odds ratio does not account for the potential influence of the other variables included in the logistic regression model, whereas an adjusted odds ratio is considered to be an estimate of the independent or separate effect of each variable, because each is adjusted statistically for the presence of the other risk factors.

This study was funded in part by grant U82/CCU408574-05 from the Centers for Disease Control and Prevention. A preliminary report of the data reported here was presented at the Meetings of the Society for Research in Child Development, Washington, DC, April 1997.

Thanks are due Paul Buescher, Sandra Martin, Kathryn McLawhorn, Robert Meyer, and Dianne Tyson for their thoughtful comments and contributions to this manuscript. Address all correspondence to the State Center for Health Statistics, P.O. Box 29538, Cotton Building, Raleigh, N.C. 27626-0538. E-mail: gabrielle_principe@mail.ehnr.state.nc.us.

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