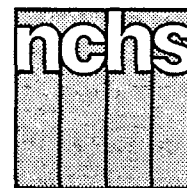


Advance Data



From Vital and Health Statistics of the National Center for Health Statistics

Children's Exposure to Environmental Cigarette Smoke Before and After Birth

Health of Our Nation's Children, United States, 1988

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Introduction

The effects of environmental exposure to cigarette smoke for the preschool child are primarily the result of two phenomena: The mother's prenatal smoking practices and the child's subsequent family environment (1). Because strong evidence exists that exposed infants and children are at higher risk for specific health and developmental problems (2,3), the vulnerability of some children may be increased according to differences in exposure to cigarette smoke among various demographic and socioeconomic groups.

The pattern of cigarette smoking in the United States has shifted over the years among sex, race, educational, and socioeconomic groups (2,4-6). Although overall prevalence rates of smoking have declined among men and women over the past decade, smoking has decreased at a slower rate among

women. Until recently, smoking initiation was increasing for the least educated young females. Also, the onset of smoking for females is occurring at younger ages. In 1987, 26 percent of women 18-24 years of age and 31 percent of those 25-44 years of age smoked (7). About twice as many women these ages with less than a high school education smoked as did college graduates (31 compared with 15 percent). Forty-one percent of those smoking during these childbearing years smoked about a pack a day; an additional 11 percent of women 18-24 years and 21 percent of women 25-44 years smoked more than this amount.

As a result, differential risk of exposure for children may have changed because of smoking patterns among persons with higher than average birth rates and those who spend more time with the developing child (8,9). This report describes

differences in exposure, both prenatally and postnatally, by demographic and socioeconomic characteristics for U.S. children 5 years of age and under. Their respondent-assessed health status according to exposure and selected characteristics is also shown.

Background

Maternal smoking during pregnancy and its adverse effects on infant health have been the subject of numerous research studies over the last three decades (2). Considerable evidence has been amassed to indicate that cigarette smoking during pregnancy increases the risk of various adverse prenatal consequences and postnatal health conditions in infants. Prenatal exposure from a mother who smokes may cause intrauterine growth retardation, low birth weight, preterm delivery, and other complications of



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pregnancy and delivery. Recent estimates suggest that elimination of smoking during pregnancy could reduce about 5 percent of perinatal deaths (10–12). In a prospective study, it was demonstrated that nonsmoking mothers exposed to environmental tobacco smoke for at least 2 hours a day had an increased relative risk of 2.17 for delivering a baby of low birth weight (less than 2,500 grams) (13).

Morbidity in older children, at least through the preschool years, also has been found to be higher for children whose mothers smoked during pregnancy than for those whose mothers did not smoke during this period (3). A number of studies have found increases in lower respiratory tract infections (bronchitis and pneumonia) in smokers' children under 2 years of age, with the strongest associations shown for maternal smoking (14–16). Other studies have found increased respiratory-related hospitalizations, wheezing, asthma, middle ear infections, febrile seizures, and reduction in physical growth (17–24). Behavioral and cognitive abnormalities affecting mental development also have been associated with maternal smoking during pregnancy (25,26). The associations with prenatal maternal smoking have held in all of these studies when controlled or stratified by socioeconomic and demographic factors related to poor health. With some of these findings, however, the effects of prenatal maternal smoking may be confounded with children's exposure to environmental smoke after birth.

In 1981, the National Health Interview Survey (NHIS) Child Health Supplement (CHS) included one question on prenatal maternal smoking. Competing priorities established for that survey dictated that the focus of the question be limited to obtaining data on the effects of low birth weight and intrauterine growth retardation.

Subsequent analysis of data from this cross-sectional representative survey of U.S. children, however,

revealed multiple adverse health outcomes among children up to 3 years of age whose mothers smoked while pregnant (27). Prenatal maternal smoking was associated with subsequent poorer health and with higher levels of restricted-activity days, bed days, hospitalizations, and number of chronic conditions. A large part of what was being measured, however, may have been potential adverse effects from sidestream smoke in the household after the children were born. Unfortunately, questions about the presence of household smoke following birth were not included in the 1981 CHS.

To sort out the different stages of exposure to smoke for the young child, the 1988 NHIS on Child Health (NHIS-CH) contained an expanded set of cigarette smoking questions about children's potential exposure both before and after birth. In particular, questions were included about the cigarette smoking practices of the sample child's mother during her pregnancy as well as the presence of cigarette smokers in the household following the child's birth.

This report compares the rates of exposure to smoke at various stages from the prenatal period to the time of the survey. Exposure estimates are shown according to the following demographic, socioeconomic, and health status indicators: Race, Hispanic origin, family income, poverty status, maternal education, place of residence, and respondent-assessed health status.

Table 1 shows the number and percent of children 5 years of age and under in the United States by whether they were ever exposed to cigarette smoke and the period(s) of exposure. Estimates of children's exposure to smoke during the prenatal period and the sources of that exposure are shown in table 2. In table 3, the estimates shown are by exposure to household smoke since birth. Table 4 shows the percent of children assessed in fair or poor health, according to selected exposure periods. Table 5 contains population denominators needed to derive various estimated frequencies for the

percentage estimates presented in tables 1–4.

Data and methods

In 1988 the National Center for Health Statistics, in collaboration with the National Institute of Child Health and Human Development and the Health Resources and Services Administration and as part of its ongoing NHIS, collected detailed information about the health of children. The National Health Interview Survey is a continuous, cross-sectional survey representing the household population of the United States. Each year, basic health and demographic information is collected in NHIS by means of face-to-face interviews with a sample of about 122,000 family members in about 47,000 families. In addition to the basic questionnaire, questions on one or more special topics are also included. Interviews are conducted by interviewers employed by the U.S. Bureau of the Census. Topics covered in the 1988 NHIS-CH include child care, marital history of the child's parents, geographic mobility, circumstances of the pregnancy and birth, injuries, impairments, acute conditions, chronic conditions, passive smoking, sleep habits, school problems, developmental problems, and use of health care services.

For each family interviewed in NHIS during 1988, one child 17 years of age and under was selected to receive the child health questionnaire according to a probability determined by birth order. About 20,000 children from birth through 17 years of age were represented. The overall response rate for NHIS-CH was about 91 percent.

The questions about children's potential exposure to cigarette smoke were asked only for sample children 5 years of age and under. This age limit was selected to limit recall problems and confounding from multiple exposures. Because some of the information being obtained referred to the mother's smoking practices during pregnancy, the accuracy of reporting was expected to

Table 1. Number of children 5 years of age and under and percent distribution by exposure to smoke before and after birth, according to selected characteristics: United States, 1988

Characteristic	Number of children in thousands ¹	Total	Never exposed to smoke	All exposures to smoke				
				Total ever exposed ²	Both prenatal and postnatal	Prenatal only	Postnatal only	Continuous exposure
Percent distribution								
All children ³	19,008	100.0	49.9 (0.9)	50.1 (0.9)	27.6 (0.9)	1.2 (0.2)	21.2 (0.7)	16.4 (0.8)
Race								
White	15,564	100.0	50.7 (1.0)	49.3 (1.0)	28.1 (1.0)	1.2 (0.2)	19.8 (0.7)	16.7 (0.8)
Black	2,759	100.0	40.3 (2.4)	59.7 (2.4)	28.8 (1.9)	1.2 (0.5)	29.7 (2.3)	17.8 (1.6)
Hispanic origin								
Non-Hispanic	16,912	100.0	49.2 (1.0)	50.8 (1.0)	28.5 (0.9)	1.2 (0.2)	20.9 (0.8)	17.2 (0.8)
Hispanic	2,096	100.0	55.7 (2.4)	44.3 (2.4)	19.9 (1.9)	0.7 (0.3)	23.5 (2.1)	10.1 (1.4)
Mexican-American	1,006	100.0	60.2 (4.1)	39.8 (4.1)	15.1 (2.7)	0.4 (0.3)	24.3 (3.3)	7.7 (1.8)
Family income								
Less than \$10,000	2,683	100.0	32.3 (2.1)	67.7 (2.1)	42.2 (2.1)	1.1 (0.4)	24.2 (2.0)	27.0 (1.9)
\$10,000–\$24,999	5,434	100.0	43.4 (1.5)	56.6 (1.5)	30.9 (1.4)	0.9 (0.3)	24.6 (1.3)	19.2 (1.3)
\$25,000–\$39,999	4,869	100.0	54.9 (1.7)	45.1 (1.7)	25.4 (1.4)	1.0 (0.3)	18.5 (1.2)	14.1 (1.2)
\$40,000 or more	4,144	100.0	64.0 (1.8)	36.0 (1.8)	17.9 (1.4)	1.6 (0.4)	16.5 (1.3)	9.3 (1.1)
Poverty status								
In poverty	3,374	100.0	35.3 (2.1)	64.7 (2.1)	36.7 (1.9)	1.1 (0.5)	26.8 (2.0)	23.5 (1.7)
Not in poverty	14,573	100.0	53.5 (1.0)	46.5 (1.0)	25.4 (0.9)	1.2 (0.2)	19.7 (0.8)	14.7 (0.8)
Mother's education								
Less than 12 years	3,279	100.0	32.9 (2.2)	67.1 (2.2)	43.0 (2.5)	0.4 (0.2)	23.4 (2.0)	30.0 (2.4)
12 years	8,012	100.0	43.2 (1.3)	56.8 (1.3)	32.5 (1.3)	1.3 (0.3)	22.9 (1.1)	19.5 (1.2)
More than 12 years	7,496	100.0	65.0 (1.2)	35.0 (1.2)	15.2 (0.8)	1.3 (0.2)	18.3 (1.0)	7.1 (0.6)
Place of residence								
MSA	14,544	100.0	50.3 (1.0)	49.7 (1.0)	27.5 (1.0)	1.2 (0.2)	20.8 (0.9)	16.4 (0.9)
Central city	5,991	100.0	48.0 (1.3)	52.0 (1.3)	27.4 (1.5)	1.4 (0.4)	23.1 (1.3)	16.5 (1.3)
Not central city	8,554	100.0	51.9 (1.4)	48.1 (1.4)	27.7 (1.2)	1.0 (0.2)	19.3 (1.1)	16.3 (1.1)
Not MSA	4,464	100.0	48.5 (2.0)	51.5 (2.0)	27.7 (1.7)	1.1 (0.4)	22.5 (1.1)	16.5 (1.5)
Assessed health status								
Excellent, very good, or good	18,193	100.0	50.3 (0.9)	49.7 (0.9)	27.4 (0.8)	1.2 (0.2)	21.0 (0.7)	16.4 (0.7)
Fair or poor	594	100.0	37.1 (5.1)	62.9 (5.1)	33.7 (4.0)	0.0 (0.0)	29.1 (5.5)	17.5 (3.1)

¹Excludes children whose total exposure to smoke is unknown.

²Includes exposed children whose period of exposure is unknown.

³Includes all other races, unknown family income, unknown poverty status, unknown education of mother, and unknown assessed health status.

NOTES: Poverty status is determined in the National Health Interview Survey by family size, number of children, and family income using 1987 poverty levels defined by the U.S. Bureau of the Census. MSA is metropolitan statistical area. Figures in parentheses are standard errors of estimates.

decrease as the interval between the pregnancy and the time of interview increased. Obtaining data on the older child presents the problem of documenting increasing outside exposure to the child compounded with the concern that children themselves may actually begin to smoke in the elementary school years.

The questions about mothers' smoking behavior during pregnancy were asked only of biological mothers who were still living in the household and available to respond at the time of the interview. Data presented in this report are limited to those children for whom prenatal maternal smoking information was available. About 11.5 percent of otherwise

eligible sample children 5 years of age and under are excluded from this analysis because the biological mother was not available for interview. Also excluded from this analysis are an additional 2 percent of eligible sample children for whom no smoking exposure information was available on the NHIS-CH questionnaire. For this report, the final NHIS-CH passive smoking sample includes 5,356 sample children representing 86 percent of U.S. children 5 years of age and under. Comparison of sample children by the demographic and socioeconomic descriptors used in this report shows no differences indicating response bias as a result of these exclusions.

The estimates presented in this report are weighted to produce representative national estimates of U.S. noninstitutionalized children 5 years of age and under, less the sample exclusions just described. This weighted national estimate represents about 19 million children. U.S. population totals for all noninstitutionalized children these ages are provided in table 5 for data users interested in approximating total U.S. estimates.

Initially, mothers were asked whether they smoked at all during the year before the child's birth. Subsequent questions included whether they continued to smoke during the entire pregnancy or

Table 2. Number of children 5 years of age and under and percent distribution by whether exposed to smoke before birth, according to selected characteristics: United States, 1988

Characteristic	Number of children in thousands ¹	Total	Not exposed before birth	Exposed before birth		
				Mother smoked	Mother and others smoked	Potential exposure
Percent distribution						
All children ²	18,849	100.0	49.4 (0.9)	28.8 (0.9)	20.8 (0.8)	21.6 (0.8)
Race						
White	15,448	100.0	49.9 (1.0)	29.3 (1.0)	21.7 (0.9)	20.7 (0.8)
Black	2,728	100.0	41.5 (2.4)	30.0 (1.9)	18.6 (1.7)	28.4 (2.3)
Hispanic origin						
Non-Hispanic	16,799	100.0	48.6 (1.0)	29.8 (0.9)	21.6 (0.9)	21.5 (0.8)
Hispanic	2,050	100.0	56.5 (2.3)	20.6 (1.8)	13.8 (1.9)	22.5 (2.4)
Mexican-American	987	100.0	59.5 (3.7)	15.4 (2.7)	9.9 (2.6)	24.7 (3.4)
Family income						
Less than \$10,000	2,679	100.0	32.1 (2.1)	43.3 (2.0)	31.5 (1.9)	24.5 (1.8)
\$10,000-\$24,999	5,372	100.0	44.1 (1.6)	31.8 (1.4)	23.3 (1.3)	23.8 (1.4)
\$25,000-\$39,999	4,833	100.0	53.3 (1.6)	26.5 (1.5)	19.6 (1.3)	20.1 (1.3)
\$40,000 or more	4,109	100.0	62.9 (1.7)	19.5 (1.4)	12.7 (1.2)	17.4 (1.3)
Poverty status						
In poverty	3,344	100.0	35.9 (2.1)	37.8 (1.9)	27.9 (1.7)	26.0 (1.8)
Not in poverty	14,456	100.0	53.0 (1.0)	26.6 (0.9)	18.9 (0.8)	20.2 (0.8)
Mother's education						
Less than 12 years	3,249	100.0	33.0 (2.1)	43.5 (2.6)	34.6 (2.3)	23.2 (1.9)
12 years	7,964	100.0	41.7 (1.4)	33.8 (1.3)	24.4 (1.2)	24.3 (1.2)
More than 12 years	7,416	100.0	65.3 (1.2)	16.5 (0.8)	10.4 (0.6)	18.0 (0.9)
Place of residence						
MSA	14,406	100.0	50.3 (1.0)	28.7 (1.0)	20.8 (1.0)	20.7 (0.9)
Central city	5,920	100.0	48.8 (1.5)	28.8 (1.5)	20.7 (1.3)	22.2 (1.5)
Not central city	8,487	100.0	51.4 (1.4)	28.7 (1.2)	20.9 (1.1)	19.7 (1.2)
Not MSA	4,443	100.0	46.5 (2.1)	28.8 (1.8)	20.8 (1.5)	24.5 (1.1)
Assessed health status						
Excellent, very good, or good	18,054	100.0	50.1 (0.9)	28.6 (0.8)	20.7 (0.8)	21.1 (0.7)
Fair or poor	574	100.0	33.0 (4.8)	33.6 (4.0)	26.3 (3.8)	32.4 (5.6)

¹Excludes children whose exposure to smoke before birth is unknown.

²Includes all other races, unknown family income, unknown poverty status, unknown education of mother, and unknown assessed health status.

NOTES: Exposure before birth includes children exposed by mothers' direct smoking as well as possible exposure from mothers' contacts who smoked. Poverty status is determined in the National Health Interview Survey by family size, number of children, and family income using 1987 poverty levels defined by the U.S. Bureau of the Census. MSA is metropolitan statistical area. Figures in parentheses are standard errors of estimates.

stopped during the first 3 months or later and the average daily number of cigarettes smoked. An additional question about potential exposure involved the frequency with which the mother was in contact with friends, coworkers, or family members who smoked during the pregnancy.

To assess a child's exposure to cigarette smoke after birth, the mother's current smoking status was determined. If she was not a current smoker, the interval since she had last smoked was ascertained. Other questions were used to determine whether any household member had smoked regularly since the child's birth. If so, determinations were

made as to (a) whether any household member currently smoked and (b) whether it had been more or less than 12 months since anyone in the household had smoked. A facsimile of the NHIS-CH questionnaire items is provided in Current Estimates from the National Health Interview Survey, 1988 (28).

Results

Exposure status

Figure 1 shows the distribution of U.S. children 5 years of age and under by whether they were ever exposed to cigarette smoke and the

proportion exposed before and after birth. About one-half of U.S. children 5 years of age and under have ever been exposed to cigarette smoke. For this report, the estimates of children ever exposed include children whose mother smoked at any time during the pregnancy or afterward and children who lived in a household where someone ever smoked regularly since their birth. More than one-fourth of all young children, on the average, were exposed to passive smoke both before and after birth.

A higher proportion of black children (60 percent) than white children (49 percent) were ever exposed, with most of the difference

Table 3. Number of children 5 years of age and under and percent distribution by whether exposed to household smoke since birth, according to selected characteristics: United States, 1988

Characteristic	Number of children in thousands ¹	Total	Not exposed since birth	Exposed since birth		
				Total ²	Current smoker in household	Former smoker in household
Percent distribution						
All children ³	19,019	100.0	51.1 (0.9)	48.9 (0.9)	42.4 (0.9)	6.1 (0.4)
Race						
White	15,575	100.0	51.9 (1.0)	48.1 (1.0)	41.6 (1.0)	6.1 (0.4)
Black	2,759	100.0	41.5 (2.4)	58.5 (2.4)	51.3 (2.4)	6.7 (1.2)
Hispanic origin						
Non-Hispanic	16,923	100.0	50.4 (1.0)	49.6 (1.0)	43.2 (1.0)	6.0 (0.4)
Hispanic	2,096	100.0	56.4 (2.6)	43.6 (2.6)	35.8 (2.5)	6.9 (1.2)
Mexican-American	1,006	100.0	60.7 (4.1)	39.3 (4.1)	31.8 (3.8)	6.5 (1.6)
Family income						
Less than \$10,000	2,685	100.0	33.4 (2.1)	66.6 (2.1)	57.7 (2.3)	8.7 (1.1)
\$10,000–\$24,999	5,436	100.0	44.3 (1.5)	55.7 (1.5)	48.8 (1.6)	6.3 (0.7)
\$25,000–\$39,999	4,871	100.0	55.9 (1.7)	44.1 (1.7)	38.3 (1.6)	5.4 (0.7)
\$40,000 or more	4,149	100.0	65.7 (1.8)	34.3 (1.8)	29.5 (1.5)	4.6 (0.9)
Poverty status						
In poverty	3,376	100.0	36.4 (2.1)	63.6 (2.1)	55.7 (2.3)	7.6 (1.0)
Not in poverty	14,582	100.0	54.8 (1.0)	45.2 (1.0)	39.2 (1.0)	5.6 (0.4)
Mother's education						
Less than 12 years	3,279	100.0	33.3 (2.2)	66.7 (2.2)	61.2 (2.1)	5.1 (0.8)
12 years	8,014	100.0	44.5 (1.4)	55.5 (1.4)	47.9 (1.4)	7.3 (0.6)
More than 12 years	7,505	100.0	66.3 (1.2)	33.7 (1.2)	27.6 (1.1)	5.4 (0.6)
Place of residence						
MSA	14,550	100.0	51.5 (1.0)	48.5 (1.0)	42.2 (1.1)	5.9 (0.4)
Central city	5,994	100.0	49.4 (1.4)	50.6 (1.4)	43.6 (1.5)	6.3 (0.6)
Not central city	8,556	100.0	52.9 (1.4)	47.1 (1.4)	41.1 (1.4)	5.6 (0.6)
Not MSA	4,469	100.0	49.7 (1.9)	50.3 (1.9)	43.1 (1.7)	6.8 (0.8)
Assessed health status						
Excellent, very good, or good	18,204	100.0	51.5 (0.9)	48.5 (0.9)	42.0 (0.9)	6.0 (0.4)
Fair or poor	594	100.0	37.1 (5.1)	62.9 (5.1)	55.7 (5.3)	6.7 (2.4)

¹Excludes children whose exposure to smoke in the home after birth is unknown.

²Includes children exposed since birth whose period of exposure is unknown.

³Includes all other races, unknown family income, unknown poverty status, unknown education of mother, and unknown assessed health status.

NOTES: Poverty status is determined in the National Health Interview Survey by family size, number of children, and family income using 1987 poverty levels defined by the U.S. Bureau of the Census. MSA is metropolitan statistical area. Figures in parentheses are standard errors of estimates.

occurring in the postnatal period (table 1). Children of Hispanic origin were less likely ever to be exposed to smoke than were non-Hispanic children (44 and 51 percent, respectively). Mexican-American children were the least likely to be exposed prenatally, but their "postnatal only" exposure was similar to that of children of other origins.

Differentials in exposure levels were also found among children by various income categories and according to mother's education. About two-thirds of young children in families with incomes of less than \$10,000 were ever exposed to smoke, compared with 36 percent of children whose family income was \$40,000 or

more, almost a twofold risk. Similarly, the overall rate of exposure to passive smoke declined as level of mother's education increased, from 67 percent of children whose mother did not complete high school to 35 percent of those whose mother had 1 year or more of college. Differences were significant at the 0.05 level between each level of income, poverty, and maternal education.

Table 1 also contains exposure estimates according to one NHIS health status measure: Respondent-assessed health status. Respondent-assessed health status for children is reported by the household respondent for NHIS, usually a parent. The question is used to determine

whether the child's overall health is considered excellent, very good, good, fair, or poor.

A higher percent of children in fair or poor health than other children were ever exposed to smoke; almost two-thirds of all children reported to be in fair or poor health were exposed to cigarette smoke either before or after their birth, compared with about one-half of all children whose overall health was reported to be excellent, very good, or good.

Although questions detailing the entire duration of smoking exposure before and after birth were not included as part of this survey, some approximation is possible to estimate

Table 4. Percent of children 5 years of age and under assessed in fair or poor health, by exposure to smoke and selected characteristics: United States, 1988

Characteristic	All children ¹	Never exposed	Total	Ever exposed		
				Mother smoked during pregnancy	Current smoker in household	Former smoker in household
Percent of children						
All children ²	3.2 (0.33)	2.4 (0.34)	4.0 (0.57)	3.7 (0.50)	4.1 (0.64)	3.5 (1.25)
Race						
White	3.0 (0.36)	2.2 (0.38)	3.7 (0.63)	3.3 (0.49)	4.0 (0.72)	3.1 (1.18)
Black	4.3 (0.95)	3.1 (1.08)	5.1 (1.37)	6.1 (2.08)	5.0 (1.42)	6.4 (4.91)
Hispanic origin						
Non-Hispanic	3.0 (0.35)	2.1 (0.34)	3.8 (0.61)	3.6 (0.53)	4.0 (0.69)	3.3 (1.34)
Hispanic	4.6 (1.07)	4.1 (1.42)	5.0 (1.59)	5.2 (2.24)	5.3 (1.88)	5.2 (3.34)
Mexican-American	5.3 (1.72)	5.5 (2.32)	4.3 (2.31)	2.4 (2.14)	5.4 (2.84)	0.0 (0.00)
Family income						
Less than \$10,000	7.0 (1.52)	4.5 (1.55)	8.1 (2.20)	7.5 (1.63)	8.0 (2.52)	10.7 (4.78)
\$10,000–\$24,999	3.6 (0.56)	2.7 (0.73)	4.4 (0.85)	3.5 (0.95)	4.6 (0.92)	3.4 (2.10)
\$25,000–\$39,999	2.7 (0.54)	2.4 (0.77)	2.9 (0.70)	3.2 (0.91)	3.3 (0.80)	0.0 (0.00)
\$40,000 or more	1.4 (0.37)	1.1 (0.37)	1.9 (0.81)	1.3 (0.94)	2.0 (0.94)	2.1 (2.05)
Poverty status						
In poverty	6.5 (1.30)	3.5 (1.12)	8.1 (1.95)	7.6 (1.64)	8.0 (2.19)	9.8 (4.44)
Not in poverty	2.4 (0.27)	2.0 (0.34)	2.9 (0.41)	2.7 (0.49)	3.2 (0.45)	1.9 (1.01)
Mother's education						
Less than 12 years	6.0 (1.28)	3.3 (1.19)	7.3 (1.82)	5.6 (1.23)	7.3 (1.96)	10.6 (6.12)
12 years	3.0 (0.47)	2.7 (0.73)	3.3 (0.57)	3.7 (0.75)	3.6 (0.65)	2.3 (1.16)
More than 12 years	1.9 (0.28)	1.8 (0.33)	2.0 (0.52)	1.6 (0.76)	1.9 (0.53)	2.5 (1.77)
Place of residence						
MSA	2.9 (0.38)	1.9 (0.36)	3.9 (0.68)	3.9 (0.59)	4.1 (0.77)	3.5 (1.44)
Central city	2.9 (0.46)	1.4 (0.46)	4.3 (0.82)	4.9 (1.14)	3.9 (0.86)	7.5 (3.21)
Not central city	2.9 (0.58)	2.2 (0.53)	3.6 (1.04)	3.2 (0.66)	4.2 (1.21)	0.4 (0.37)
Not MSA	4.0 (0.66)	4.0 (0.85)	4.1 (0.95)	3.1 (0.88)	4.4 (1.04)	3.6 (2.55)

¹Excludes children whose total exposure to smoke is unknown.

²Includes all other races, unknown family income, unknown poverty status, and unknown education of mother.

NOTES: Poverty status is determined in the National Health Interview Survey by family size, number of children, and family income using 1987 poverty levels defined by the U.S. Bureau of the Census. MSA is metropolitan statistical area. Figures in parentheses are standard errors of estimates.

the proportion of children at highest risk, that is, those continuously exposed from the prenatal period to the time of interview. For this report children were classified as being “continuously” exposed to cigarette smoke if either (a) their mother smoked during the entire pregnancy and currently smokes or (b) their mother smoked during the entire pregnancy, a household member smoked regularly since their birth, and a household member currently smokes.

Using this operational definition, about 16 percent of U.S. children—one in six—have been exposed continuously, that is, prenatally to tobacco smoke constituents and postnatally to sidestream smoke in the household. About the same proportion of black and white children experienced

continuous exposure to smoke, but more non-Hispanic than Hispanic children were exposed continuously (17 percent and 10 percent, respectively). Children in families with incomes of less than \$10,000 were three times as likely to be exposed from conception to the current time as were those with family incomes of \$40,000 or more (27 and 9 percent). Children whose mother had not completed high school were four times as likely to be exposed as those whose mother continued her education beyond high school (30 and 7 percent).

Prenatal exposure

In table 2 estimates of children's exposure to smoke before birth are expanded. The criteria for classifying children's exposure to cigarette smoke

used for this table also differ from those used for figure 1 and table 1. For most of the exposure status categories shown in table 2, the data incorporate estimates for children whose mother was often in contact with a smoker (such as friends, coworkers, or family members who smoked).

Some of the four categories shown in table 2 are not mutually exclusive. They are defined in the following way:

- “Not exposed before birth” includes children whose mother did not smoke at all during pregnancy and did not often come in contact with persons who smoked.
- “Mother smoked” includes all children whose mother reported

Table 5. Number of children 5 years of age and under, by selected sociodemographic characteristics and assessed health status: United States, 1988

Characteristic	Number in thousands
Total ¹	22,107
Race	
White	17,828
Black	3,336
Hispanic origin	
Non-Hispanic	19,570
Hispanic	2,537
Mexican-American	1,229
Family Income	
Under \$10,000	3,046
\$10,000-\$24,999	6,279
\$25,000-\$39,999	5,550
\$40,000 or more	4,905
Poverty status	
In poverty	3,878
Not in poverty	16,906
Mother's education	
Less than 12 years	3,959
12 years	9,071
More than 12 years	8,604
Place of residence	
MSA	16,924
Central city	7,038
Not central city	9,886
Not MSA	5,183
Assessed health status	
Excellent, very good, or good	21,198
Fair or poor	664

¹Includes all other races, unknown family income, unknown poverty status, unknown education of mother, and unknown assessed health status.

NOTES: Poverty status is determined in the National Health Interview Survey by family size, number of children, and family income using 1987 poverty levels defined by the U.S. Bureau of the Census. MSA is metropolitan statistical area.

- smoking at all during the pregnancy.
- "Mother and others smoked" refers to children whose mother smoked at all during the pregnancy and also often came in contact with someone who smoked. This category is a subset of the preceding category (mother smoked), which includes these children as well as children of mothers who smoked but did not come in contact frequently with other smokers.
- "Potential exposure" includes children whose mother did not smoke at all during pregnancy but was often in contact with persons, such as friends, coworkers, or family members, who smoked.

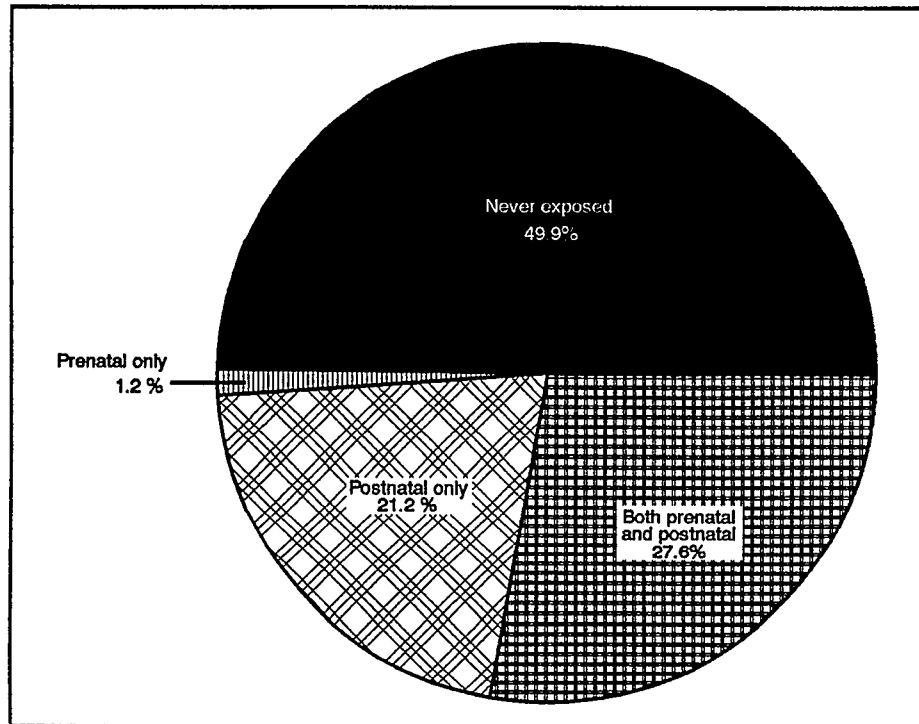


Figure 1. Percent distribution of children 5 years of age and under by exposure to smoke before and after birth: United States, 1988

Children in this category, by definition, are not included in any of the preceding categories.

About 29 percent of all children, regardless of race, were exposed prenatally to smoke as a direct result of their mother's smoking. The percent of children of Hispanic origin exposed before birth as a consequence of their mother's smoking was somewhat lower, about 20 percent. Proportionately about twice as many youngsters from the lowest family income category were exposed from their mother's smoke (43 percent) as were children whose family's total earnings were \$40,000 or more (20 percent). The risk of exposure prior to birth from mothers' smoke was more than 2½ times as great for children of mothers with less than a high school education (44 percent) as for those whose mother had 1 year or more of college (17 percent).

On the average, more than one-fourth of the Nation's children were exposed to maternal smoke. However, this estimate rises to 50 percent when children whose nonsmoking mothers were exposed to

sidestream smoke during pregnancy are also considered potentially at risk. Overall, about 22 percent of children were reported to have mothers exposed frequently to cigarette smoke, even though they were not smokers themselves. This estimate was somewhat higher for black children (28 percent, compared with 21 percent of white children). Proportionately there were more children with nonsmoking mothers exposed to smoke among families comprising the lowest income and maternal education categories than among families with incomes of \$40,000 or more and mothers with more than 12 years of education.

The proportions of children with potential exposure, shown in table 2, are very similar to those of children exposed postnatally only by household members, shown in table 1, suggesting that household exposure may be the main potential source for pregnant nonsmoking mothers.

Postnatal exposure

Forty-two percent of all U.S. children 5 years of age and under

were currently living in a household with a smoker (table 3). This estimate was highest among black children: On the average, one out of two black children lived with someone who smoked. Only 6 percent of U.S. children lived in households where smoking had ceased since the child was born. Proportionately fewer Hispanic children than others were currently exposed in the home (36 percent).

As with the estimates of children exposed to cigarette smoke prenatally, a disproportionately high number of children comprising the lower income and education categories were currently exposed to smoke in the home. Fifty-eight percent of those whose family income was less than \$10,000 were living with a smoker, compared with 30 percent of children in families with incomes of \$40,000 or more, a twofold risk. More than twice as many children having mothers with less than 12 years of education were currently exposed to household smoke (61 percent) as were children whose mothers reported completing 1 year or more of college (28 percent).

A higher proportion of children in fair or poor health were reported to be living in households with a current smoker: 56 percent versus 42 percent of those whose overall health was said to be good to excellent.

The percent of children living with a household member who had quit smoking appears to be higher among those with incomes less than \$10,000 or in poverty (9 and 8 percent, respectively) than the overall average of 6 percent. These differences may be due to sampling variation. However, the level of current smokers is still highest in these categories.

Exposure and assessed health status

As previously mentioned, parents are asked to assess their children's overall health as part of the basic NHIS interview. Accordingly, about 3 percent of all U.S. children 5 years of age and under are said to be in fair or poor health (table 4). The

relative risk of fair or poor health was almost twice as great for children who lived in households with current smokers as it was for children who were never exposed—4.1 and 2.4 percent, respectively. This approximate ratio also is observed between the estimates for most of the smoking categories shown in table 4. However, the differences seen are not statistically significant at the 0.05 level when the standard errors associated with these estimates are considered.

Nevertheless, the estimates in table 4 are included in this report to show an apparent pattern suggesting that, for most children, fair or poor health appears to be associated with various exposures to cigarette smoke. Children currently exposed appear to be at somewhat greater risk than those formerly exposed, whether at home or prenatally. The children at least risk appear to be those who have never been exposed to cigarette smoke at all. The estimates presented in this table should be interpreted with caution, however, because sampling variability may account for the differences that are observed and other determinants of perceived health status have not been taken into account.

Summary

In this report, the differences found in exposure by family income, poverty, and total years of maternal education follow what is known about overall smoking rates in the U.S. population (1-6). Overall, about one-half of all U.S. children 5 years of age and under have been exposed to environmental cigarette smoke from prenatal maternal smoking and/or sidestream smoke from household members after their birth. Twenty-one percent were exposed only after they were born, and 28 percent were exposed both from prenatal maternal smoking and subsequent household exposure. Sixteen percent were continuously exposed.

The findings show that a large proportion of children at disadvantage from low income and

educational levels in the household are also at increased risk of exposure to maternal and sidestream smoke, potentially adding to differentials in their health risks. The differences in exposure by family income, poverty status, and total years of maternal education are consistent with current smoking patterns of the U.S. population during the childbearing years. Children 5 years of age and under in families with the lowest income levels were almost twice as likely to have ever been exposed as those with the highest incomes (68 percent compared with 36 percent). Almost twice as many children living in households where the mother had not completed high school as in those where the mother had completed 1 or more years of college had ever been exposed (67 percent compared with 35 percent).

Black children were more likely to have ever been exposed than white children (60 and 49 percent, respectively). Non-Hispanic children were more likely to have been exposed than Hispanic children (51 and 44 percent, respectively), with Mexican-American children the least likely to have been exposed (40 percent).

The children least likely to have been continuously exposed since conception had mothers with more than 12 years of education (7 percent) or lived in households with family incomes of \$40,000 or more (9 percent). Hispanic children were also less likely to be exposed continuously. Mexican-American children had one-half the risk of continuous exposure (8 percent) than non-Hispanic children had (17 percent), because Mexican-American mothers were one-half as likely as others to smoke while pregnant (16 percent compared with 30 percent).

Patterns are similar for children currently living with smokers. About twice as many children living in families with the least income as in families with an income of \$40,000 more were exposed (58 percent versus 30 percent). Children living

with mothers with less than 12 years of education were more than twice as likely to be living with a current smoker (61 percent) as those with the most educated mothers (28 percent). However, 32 percent of Mexican-American children currently lived with a smoker, compared with 43 percent of non-Hispanic children.

The differences found among educational, racial, and ethnic groups reinforce the concern about advertising targeted to the most vulnerable populations (2,6,8,29). The focus of appropriately specific intervention should be intensified for the highest risk groups of parents and parents-to-be.

References

- National Research Council Committee on Passive Smoking. Environmental tobacco smoke: Measuring exposures and assessing health effects. Washington: National Academy Press. 1986.
- Office of the Surgeon General. Reducing the health consequences of smoking: 25 years of progress. A report of the Surgeon General. Washington: U.S. Department of Health and Human Services. 1989.
- Rush D, Callahan KR. Exposure to passive cigarette smoking and child development: A critical review. *NY Acad Science* 562:74-100. 1989.
- Fiore MC, Novotny TE, Pierce JP, et al. Trends in cigarette smoking in the United States: The changing influence of gender and race. *JAMA* 261:49-55. 1989.
- Pierce JP, Fiore MC, Novotny TE, et al. Trends in cigarette smoking in the United States: Educational differences are increasing. *JAMA* 261:56-60. 1989.
- Escobedo LG, Anda RF, Smith PF, et al. Socioeconomic characteristics of cigarette smoking initiation in the United States: Implications for smoking prevention policy. *JAMA* 264:1550-5. 1990.
- Schoenborn CA, Boyd G. Smoking and other tobacco use, United States, 1987. National Center for Health Statistics. *Vital Health Stat* 10(169). 1989.
- Ernst VL. Trends in smoking, cancer risk, and cigarette promotion: Current priorities for reducing tobacco exposure. *Cancer* 62:1702-12. 1988.
- Prager K, Malin H, Graves C, et al. Maternal smoking and drinking behavior before and during pregnancy. In: Health, United States, 1983. Washington: National Center for Health Statistics. 1983.
- Office of the Surgeon General. Health benefits of smoking cessation. A report of the Surgeon General. Washington: Centers for Disease Control. 1990.
- Institute of Medicine Committee to Study the Prevention of Low Birthweight. Preventing low birthweight. Washington: National Academy Press. 1985.
- Sexton M, Hebel JR. A clinical trial of change in maternal smoking and its effect on birth weight. *JAMA* 251:911-5. 1984.
- Martin TR, Bracken MB. Association of low birth weight with passive smoke exposure in pregnancy. *Am J Epidemiol* 124:633-42. 1986.
- Fergusson DM, Horwood LJ, Shannon FT, Taylor B. Parental smoking and lower respiratory illness in the first three years of life. *J Epidemiol Community Health* 35:180-4. 1981.
- Bland M, Bewley BR, Pollard V, Banks MH. Effect of children's and parents' smoking on respiratory symptoms. *Arch Dis Child* 53:100-5. 1978.
- Colley JRT, Holand WW, Corkhill RT. Influence of passive smoking and parental phlegm on pneumonia and bronchitis in early childhood. *Lancet* 11:1031-7. 1974.
- Office of the Surgeon General. The health consequences of smoking: Chronic obstructive lung disease. A report of the Surgeon General. Rockville, Maryland: U.S. Department of Health and Human Services. 1984.
- Neuspiel DR, Rush D, Butler NR, et al. Parental smoking and post-infancy wheezing in children: A prospective cohort study. *Am J Public Health* 79:168-71. 1989.
- Bonham GS, Wilson RW. Children's health in families with cigarette smokers. *Am J Public Health* 71:290-3. 1981.
- Weiss ST, Tager IB, Speizer FE, Rosner B. Persistent wheeze: Its relation to respiratory illness, cigarette smoking and level of pulmonary function in a population sample of children. *Am Rev Respir Dis* 122:697-707. 1980.
- Weitzman M, Gortmaker S, Sabol A. Racial, social and environmental risks for childhood asthma. *Am J Dis Child* 144:1189-94. 1990.
- Kraemer MJ, Richardson MA, Weiss NS, et al. Risk factors for persistent middle-ear effusions: Otitis media, catarrh, cigarette smoke exposure and atopy. *JAMA* 249:1022-5. 1983.
- Cassano PA, Koepsell TD, Farwell JR. Risk of febrile seizures in childhood in relation to prenatal maternal cigarette smoking and alcohol intake. *Am J Epidemiol* 132:462-73. 1990.
- Fox NL, Sexton M, Hebel JR. Prenatal exposure to tobacco: I. Effects on physical growth at age three. *Int J Epidemiol* 19:66-71. 1990.
- Naeye RL, Peters EC. Mental development of children whose mothers smoked during pregnancy. *Obstet Gynecol* 64(5):601-7. 1984.
- Sexton M, Fox NL, Hebel JR. Prenatal exposure to tobacco: II. Effects on cognitive functioning at age three. *Int J Epidemiol* 19:72-7. 1990.
- Moss AJ, Overpeck MD, Hendershot GE, et al. Prenatal smoking and childhood morbidity. In: Rosenberg MJ, ed. Smoking and reproductive health. Littleton, Massachusetts: PSG Publishing Co., Inc., 127-33. 1987.
- Adams PF, Hardy AM. Current estimates from the National Health Interview Survey, 1988. National Center for Health Statistics. *Vital Health Stat* 10(173). 1989.
- Warner KE. Selling smoke: Cigarette advertising and public health. Washington: American Public Health Association, 43-57. 1986.
- Shah BV. SESUDAAN: Standard errors program for computing standardized rates from sample survey data. Research Triangle Park, North Carolina: Research Triangle Institute. 1981.

Technical notes

Methods

The estimates presented in this report are based on data from the National Health Interview Survey (NHIS), an ongoing survey of U.S. households conducted by the National Center for Health Statistics. Each week, a probability sample of the civilian noninstitutionalized population of the United States is interviewed by personnel of the U.S. Bureau of the Census. Interviewers obtain information about the health and other characteristics of each member of the households included in the NHIS sample.

NHIS consists of two parts: (a) a basic health questionnaire that remains the same each year and is completed for each household member and (b) special topics questionnaires that vary from year to year and usually are asked of just one person in each family. In 1988, the special topics included acquired immunodeficiency syndrome (AIDS) knowledge and attitudes, medical device implants, occupational health, alcohol, and child health. These data sets can be linked to provide additional sources for analysis.

The total sample interviewed for 1988 for the basic health questionnaire consisted of 47,485 households containing 122,310 individuals. The total response rate was 95 percent. For the National Health Interview Survey on Child Health (NHIS-CH), one sample child 17 years of age and under was selected from each family with children in that age range. Interviews were completed for 17,110 children 17 years of age and under, 95 percent of those identified as eligible on the basis of the basic health questionnaire. The overall response rate for NHIS-CH was 91 percent, the product of the response rates for the basic and child health questionnaires.

Because the estimates presented in this report are based on a sample of the population, they are subject to sampling errors. Standard errors of

the estimates have been included in the tables. The standard errors for this report were calculated using SESUDAAN, a SAS-based software package designed to produce standard errors for estimates based on complex, multistage sample designs (30). Standard errors based on such survey designs are typically about 20 percent larger than those that would be obtained with a simple random sample of the same size.

In this report, persons whose overall smoking exposure was unknown for certain items were excluded from both the denominators and numerators of percents and percent distributions. This exclusion of unknowns implicitly assumes that the response distribution for these persons is the same as that for persons for whom valid responses were provided.

All differences cited in this report are statistically significant at the 0.05 level. The *t*-test, with a critical value of 1.96, was used to test all pairwise comparisons. Lack of comment regarding the difference between any two estimates does not mean that the difference was tested and found not to be statistically significant.

The results presented in this report were derived from a corrected version of the 1988 NHIS-CH data tape. The original NHIS-CH public use tape, released in 1990, does not contain information about prenatal exposure to smoke for about 10 percent of eligible sample children because of an incorrect editing procedure. Persons interested in purchasing a revised version of the public use tape should request the corrected copy by writing the Division of Health Interview Statistics, National Center for Health Statistics, 6525 Belcrest Road, Hyattsville, Maryland 20782.

Definition of terms

Children's exposure to cigarette smoke

Never exposed—Mother did not smoke at all either during the pregnancy or after the child's birth,

and no household member has smoked regularly at any time since the child's birth.

Ever exposed—Mother smoked during some part of the pregnancy or after the child's birth, or a household member has smoked regularly at any time since the child's birth.

Prenatal exposure only—Mother smoked during some part of the pregnancy but did not smoke after the child's birth, and no household member has smoked regularly at any time since the child's birth.

Postnatal exposure only—Mother did not smoke at all during the pregnancy, and mother smoked after the child's birth or a household member has smoked regularly at some time since the child's birth.

Prenatal and postnatal exposure—Mother smoked during some part of the pregnancy, and mother smoked after the child's birth or a household member has smoked regularly at some time since the child's birth.

Continuous exposure—Mother smoked during the entire pregnancy, and mother reported smoking at time of interview or another household member smoked regularly since the child's birth and reported smoking at time of interview.

Prenatal exposure—Terms used only in table 2:

Not exposed before birth—Mother did not smoke at all during the pregnancy and while pregnant was not often in contact with persons who did smoke, such as friends, coworkers, or family members.

Exposed before birth (mother smoked)—Mother smoked during some part of the pregnancy.

Exposed before birth (mother and others smoked)—Mother smoked during some part of the pregnancy and was often in contact with other persons who smoked, such as friends, coworkers, or family members.

Exposed before birth (potential exposure)—Mother did not smoke at all during the pregnancy but

while pregnant was often in contact with persons who did smoke, such as friends, coworkers, or family members.

Exposed since birth—Mother or another household member smoked since the child's birth.

Current smoker in household—Mother or another household member reported smoking at time of interview.

Former smoker in household—Mother or another household member smoked since the child's birth, but no household member reported smoking at time of interview.

Not exposed since birth—Mother did not smoke since the child's birth, and no other household member smoked regularly at any time since the child's birth.

Demographic terms

Race—The population is divided into three groups according to race—white, black, and all other races. Persons are classified according to the respondents' reported racial identifications. In this report, those of all other races, although not shown as a separate category, are represented in the estimates of "all children."

Hispanic origin—A person is classified as Hispanic if the household respondent reports one of the following groups as his or her national origin or ancestry: Puerto Rican, Cuban, Mexican, Latin American, or other Spanish.

Non-Hispanic origin—Persons not classified as Hispanic are non-Hispanic. This category includes persons whose Hispanic status is unknown.

Family income—This includes the total of all income for the past 12 months received by members of the child's family. Income from all sources is included, for example, wages, salaries, rents from property, pensions, and help from relatives.

Poverty status—Persons are classified as being in poverty or not in poverty according to the poverty index originated at the Social Security

Administration in 1964 and revised by the Federal Interagency Committees in 1969 and 1980. The index, based on money income only, is derived from the Department of Agriculture's 1961 economy food plan and reflects the different consumption requirements of families according to their size and composition. The poverty thresholds are updated annually to reflect changes in the Consumer Price Index. Because NHIS data on family income are collected by income categories rather than in specific amounts of money, the NHIS estimates of persons living in poverty will vary slightly from the Current Population Survey estimates.

Mother's education—The categories reflect the total number of years of regular school the child's mother completed. A regular school is one that advances a person toward an elementary or high school diploma or a college, university, or professional school degree.

Place of residence—A person's residence is classified according to whether it is inside a metropolitan statistical area (MSA) or outside an MSA. Generally speaking, an MSA consists of a county or group of counties containing at least one city having a population of 50,000 or more plus adjacent counties that are metropolitan in character and are economically and socially integrated with the central city.

Central city—The largest city in an MSA is always a central city. One or two additional cities may be secondary central cities provided that their population is one-third or more of the largest city, with a minimum population of 25,000, or that they have at least 250,000 inhabitants.

Not central city—This includes all of the MSA that is not part of the central city itself.

Not in MSA—This includes all other places in the country.

(child's) health is excellent, very good, good, fair, or poor?"

Health measures

Respondent-assessed health status—The categories related to this health measure result from asking the NHIS respondent, "Would you say

Suggested citation

Overpeck MD, Moss AJ. Children's exposure to environmental cigarette smoke before and after birth: Health of our Nation's children, United States, 1988. Advance data from vital and health statistics; no 202. Hyattsville, Maryland: National Center for Health Statistics. 1991.

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