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Environmental Tobacco Smoke Exposure Among Urban Children

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ABSTRACT. *Background.* Environmental tobacco smoke (ETS) exposure is a well-known health hazard for children. Poor urban children may be at increased risk of exposure from nonparental sources of tobacco smoke. The unique problems of ETS exposure in urban children have previously not been well-defined.

Objectives. This study was conducted: 1) to identify the sources of ETS exposure for children attending a hospital-based pediatric resident practice; and 2) to examine caregivers' perceptions of the pediatrician's role and action in addressing ETS exposure.

Design. Questionnaires were administered to a convenience sample of 174 caregivers of children visiting a children's hospital-based resident practice. A structured face-to-face interview was used.

Results. All caregivers agreed to participate in the study. Most of the caregivers interviewed were mothers (87.9%). Although only 14% of caregivers were smokers, 49.4% reported caring for at least 1 smoke-exposed child. Most smoke exposure occurred in the home; smoking is allowed in the home of 75% of the children who live with a smoker (48/64). Thirty-four percent of the caregivers who reported no smoking in the home reported having a child who spends time in homes where other people smoke. Most exposure outside the home occurred at a grandparent's home. A ban on smoking in the home did not eliminate a child's risk of residential smoke exposure but did predict whether smoking occurred in the same room as the child. All caregivers reported believing that tobacco smoke is harmful. Approximately one half of caregivers who smoke (54.2%) would like smoking cessation advice from the child's pediatrician. Interest in receiving advice on helping others quit smoking was also high (51.3%) among nonsmoking caregivers who cared for a smoke-exposed child.

Conclusions. Nonparental sources of ETS exposure are reported to be common in urban children. Children may be exposed to tobacco smoke even in homes where smoking is banned. Many caregivers would like help from pediatricians in reducing children's exposure to tobacco smoke. *Pediatrics* 2000;106(4). URL: <http://www.pediatrics.org/cgi/content/full/106/4/e47>; caregivers, environmental exposure, questionnaires, smoking, tobacco smoke pollution.

ABBREVIATION. ETS, environmental tobacco smoke.

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The burden of environmental tobacco smoke (ETS) exposure is well-known among pediatricians.¹ Cigarette smoke was cited as the greatest environmental hazard in a recent survey of practicing pediatricians in the United States.² Respiratory illness, particularly in young children, has been shown to be associated with the degree of ETS exposure.^{1,3} Advising parents to quit smoking is a recommended part of pediatric practice,⁴⁻⁶ and a substantial percentage of pediatricians report advising parents to quit smoking.⁷⁻⁹ Reducing children's exposure to ETS is an appropriate goal for the practicing pediatrician.

The prevalence of pediatric ETS exposure is known to vary from state to state. The most recent report of state-specific prevalence of children's exposure to ETS¹⁰ is based on data from the 1996 Behavioral Risk Factor Surveillance System. The state-specific prevalence of children's ETS exposure is determined from 2 factors: 1) the percentage of households in which there is a current cigarette smoker and children; and 2) the percentage of households in which smoking is allowed.¹⁰ State-specific prevalence of children's in-home smoke exposure in 1996 was estimated to range from a low of 11.7% (Utah) to a high of 34.2% (Kentucky).¹⁰

There may be pediatric subpopulations at increased risk of smoke exposure. Highly smoke-exposed children can be expected in locations with high parental smoking prevalence, greater numbers of cigarettes smoked in the same room as the child, and higher degrees of crowding.¹¹ The amount of time children spend indoors in a given area will also create greater potential for ETS exposure. Previous work has suggested that ETS may be considered an urban toxicant as well as an individual residential exposure.¹²

Restrictions on smoking in the home can have a powerful effect on the prevalence of pediatric tobacco smoke exposure. In the 1996 estimates of pediatric smoke exposure, the District of Columbia was reported as having one of the highest rates of ETS exposure among children and adolescents (31.8%), despite having the lowest prevalence of smokers who live with children (7%).¹⁰ The high rate of pediatric smoke exposure in the District of Columbia stems, in part, from having the lowest rate of restrictions on smoking in US homes (4.4%).¹⁰ Crowding in the homes of smokers may also influence the prevalence of pediatric ETS exposure in the general population.

Many pediatricians face the challenge of working with children exposed to ETS from nonparental or even nonresidential sources. Children living in ex-

tended families or spending significant time in the homes of family friends and relatives who smoke may be one such group. Past research has highlighted the difficulty that health care providers have in counseling with smoking parents.¹³ Nonparental sources of ETS exposure may seem beyond the ability of the practicing pediatrician to address.

This study examines potential sources and quantity of ETS exposure in a sample of poor urban children. We investigated restrictions on smoking in the home and caregiver's level of interest in receiving advice on reducing ETS. Pediatricians may better address the important consequences of ETS by recognizing sources of risk and potential for modifying smoking behavior within the home.

METHODS

Study Design

The study is a descriptive survey of children's caregivers visiting a primary care pediatric practice.

Setting and Study Participants

The survey was conducted in an urban, children's hospital-based, primary care pediatric resident practice. The practice provides ~14 000 patient visits per year to a predominantly black population. Eighty percent of children seen in the practice are receiving Medicaid or are Medicaid-eligible. Eligible subjects were all adult (≥ 18 years of age) caregivers of children being seen for general pediatric care. Caregivers were excluded if they were < 18 years of age, unable/unwilling to give informed consent, or did not know the child well enough to answer the survey accurately.

The study population was a convenience sample of children and caregivers visiting the clinic during 7 consecutive weekdays in February 1999. An attempt was made to survey all caregivers.

Survey Instrument

The survey instrument is an 18-item, closed-ended question format, face-to-face interview. Completion of the survey took < 10 minutes. The domains measured by the survey include: caregiver demographics; quantity and sources of smoke exposure both inside and outside of the home; whether smoking is allowed in the home where the child lives or in the homes of other smokers where the child visits; caregiver beliefs about the harmful effects of smoke exposure; and caregiver's report of, and desire for, advice from pediatricians about smoking cessation and reducing smoke exposure.

Method of Study Conduct

Interviews were conducted with parents and primary caregivers who visited the practice during the 7-day study period. Anonymous and confidential surveys were used. A single interviewer recruited all subjects and read all items of the survey instrument to the caregiver.

The unit of analysis is 1 child with a physician appointment on the survey day per caregiver. For caregivers who had > 1 child with an appointment, a die roll was used to select the child for whom questions would be answered.

This study was approved by the Human Investigation Committee of Wayne State University. Verbal informed consent was obtained from all subjects. Participation in the survey was voluntary.

Analysis and Statistical Methods

All analyses were conducted using the SPSS for Windows (Version 8.0) statistical package (SPSS, Inc, Chicago, IL). Univariate comparisons between groups were made using independent t tests for continuous measures and χ^2 analysis for categorical variables. Two-sided P values $< .05$ were considered evidence of statistical significance in the differences between groups.

RESULTS

One hundred seventy-four caregivers were approached for the survey. All caregivers were eligible to participate and gave consent to be interviewed. The demographics of the study sample are shown in Table 1. There were no statistically significant differences in the demographics of the smoke-exposed and nonsmoke-exposed children. The caregivers reported that none of the children smoked cigarettes.

Data on smoke exposure in the home and restrictions on smoking are available for 172 children (98.9%). Only 14% of the caregivers were smokers (24/172). Smoking is allowed in 75% of the homes (48/64) in which the child lives with a smoker and 16.7% of homes (18/108) in which there are no smokers ($P < .001$, by Pearson χ^2 ; $\chi = 57.8$; $df = 1$). Sixteen of the 24 caregivers who smoke reported smoking in the home. Mothers were the majority of the caregivers who smoked in the home (13/16). Other respondents who smoked in the home were 1 father, 1 grandmother, and 1 foster mother. Most smoke exposure in the home for this population was from noncaregiver sources. Of the 32 nonsmoking caregivers who reported at least 1 smoker in the home, grandmothers (46.9%) and fathers (25.0%) were the most commonly identified source of ETS.

Approximately one third of children (34.3%) who do not live with a smoker spend time in places where people smoke (37/108). Caregivers reported that smoking is allowed in 29 of these homes, banned in 4 homes, and smoking rules were not known in the remaining 4 locations. At a minimum, 26.8% of children who do not live with smokers are smoke-exposed (29/108). Hours spent by the child at these homes averaged 17.3 ± 20.6 hours per week. The most common location for ETS exposure outside the home was a grandparent's home (23/29). Smoke exposure was reported for 2 children in home daycare situations.

The effect of home smoking restrictions on a child's reported smoke exposure is seen in Table 2. For children who live with a smoker, a ban on smoking in the home did not eliminate smoke exposure in the home. In this small sample, one half of the caregivers who reported having a smoker in the house

TABLE 1. Population Demographics ($n = 174$)

Race of caregiver	
Black	93.7%
White	4%
Other	2.3%
Age of caregiver	30 ± 11.5 y
Education of caregiver	
< 9 th grade	1.1%
9th–12th grade	23%
High school graduate	43.1%
Any higher education/training	30.4%
Did not answer	2.3%
Relationship of caregiver to child	
Mother	87.9% (153)
Foster mother	3.4% (6)
Grandmother	2.9% (5)
Father	2.3% (4)
Other	3.4% (6)
Number of children with appointments	$1.3 \pm .6$
Age of child selected	3 ± 3.5 y

TABLE 2. Effect of Home Smoking Restrictions on Reported Smoke Exposure of the Child for Children Who Live With a Smoker ($n = 64$)

	At Least 1 Reported Person Smokes in Home	Someone Smokes in Same Room as Child
Smoking allowed in the home ($n = 48$)	91.7% (44)	85.4% (41)
Smoking not allowed in the home ($n = 16$)	50% (8)	8.3% (1)

and a smoking ban in the home said someone smokes in the home (8/16). However, in smoking banned homes in which a smoker lives ($n = 16$), there was only 1 person who smoked in the same room as the child. In determining the prevalence of caregivers who care for a smoke-exposed child, we have used the report of smoking in the house, rather than the report of smoking restrictions. When this is considered for all children in our study, at least 49.4% of caregivers (67/172) report a smoke-exposed child.

Most caregivers reported that the child's pediatrician had inquired about smoking and smoke exposure in the past year (Table 3). Over 90% of caregivers have seen the child's pediatrician in the last year. There were no significant differences in age or smoking status between caregivers who reported being asked about smoke exposure and those who had not been asked about smoke exposure.

Caregivers' beliefs about the harmful effects of cigarette smoke were assessed using 2 questions on a 5-point Likert scale. The degree of agreement with the following 2 statements was elicited: "Cigarette smoke is bad for health" and "Cigarette smoke is harmful to children." Nearly all caregivers strongly agreed with both of these statements. When asked whether cigarette smoke is bad for health, there were 166 valid responses, with 164 strongly agreeing with the statement and 2 who agreed. Similarly, when asked whether cigarette smoke is harmful to children, there were 166 who strongly agreed and 2 who agreed of 168 valid responses.

Among caregivers who smoke, 54.2% (13/24) reported that they would like advice from the child's pediatrician on how to quit smoking. Only 12.5% of smoking caregivers (3/24) reported that the child's pediatrician had offered them help in quitting smoking. Nearly one half of caregivers who smoke (45.8%) also reported that they would like the pediatrician's advice on helping other household members quit

TABLE 3. Caregiver Report of Inquiries in the Past Year by the Pediatrician About Smoke Exposure ($n = 174$)

	Yes (%)	No (%)	Haven't Visited in Past Year (%)	No Answer (%)
Pediatrician asked whether the caregiver smokes	63.2	28.7	4.6	3.4
Pediatrician asked about smoking in the home	70.1	21.8	4.6	3.4
Pediatrician asked about smoke exposure	75.9	17.2	2.3	4.6

smoking. There were no statistically significant differences in age or educational level between those who wanted advice and those who did not want advice from the pediatrician.

There were 77 nonsmoking caregivers who reported caring for a smoke-exposed child. Thirty-seven of these caregivers reported that the child was only smoke-exposed outside the home. The remaining 40 caregivers reported that the child lives with a smoker. Complete data were available for 37 of these 40 caregivers. Table 4 shows caregiver age and interest in receiving advice on helping others quit smoking for these 2 groups of nonsmoking caregivers. Overall, 51.3% of nonsmoking caregivers who care for a smoke-exposed child would like advice from the pediatrician on helping others quit smoking. For children who live with a smoker, among nonsmoking caregivers, older caregivers were more likely to be interested in receiving advice on helping others quit smoking (Table 4). There were no differences in the educational level of these 2 groups.

DISCUSSION

Past work suggests that exposure to ETS may be far more ubiquitous than reported by questionnaire.^{12,14,15} Data from the Third National Health and Nutrition Examination Survey (1988–1991) showed that 87.9% of nontobacco users in the United States had detectable levels of serum cotinine, a metabolite of nicotine.¹⁵

In a 1996 report by Weaver et al,¹² the prevalence of urine cotinine was 98.7% in a sample of lead-exposed children in which only 67.1% of the children were reported by the parents as having been ETS-exposed in the previous 48 hours. Nonparental sources of ETS, such as visitors and grandmothers, were a significant source of exposure in this group. Our survey suggests several potential hidden sources of ETS exposure in urban children. Foremost, 34.3% of children who do not live with a smoker spend time in a place with smokers. Some children do not live with a smoker, yet smoking is allowed in the home. These homes might have frequent or regular visitors who smoke. Finally, asking whether smoking is allowed in the home may not predict whether a child is actually exposed to ETS.

Restrictions on household smoking have been proposed as an important means for reducing adoles-

TABLE 4. Age and Interest in Receiving Advice on Helping Others Quit Smoking Among Nonsmoking Caregivers of Smoke-Exposed Children

Child lives with smoker ($n = 37$)*	Yes	No
Interest in receiving advice on helping others quit smoking		
Percent of respondents (number)	62.2% (23)	37.8% (14)
Age (y)	31.13 ± 15.08†	22.36 ± 4.10
Child smoke-exposed out of home only ($n = 37$)	Yes	No
Interest in receiving advice on helping others quit smoking		
Percent of respondents (number)	40.5% (15)	59.5% (22)
Age (y)	27.33 ± 7.72	27.82 ± 6.96

* Three cases excluded (missing data).

† $P = .014$, 2-tailed, equal variances not assumed.

cent exposure to ETS.¹⁶ Our study suggests that household smoking restrictions may not eliminate smoking in the home. Smoking occurred in 50% of the homes in which a smoker lived but smoking is not allowed. These findings are particularly important when determining the prevalence of ETS exposure in children. Estimates of children's exposure to ETS in the United States are based on whether smoking is allowed in the home.¹⁰ In the present study, simply asking about home smoking restrictions and accepting them as strictly enforced resulted in a falsely low estimate of smoke exposure. Some children are exposed to smoke in homes where smoking is not allowed and some caregivers did not know the smoking rules in homes where the children spend time with smokers. A biomarker, such as cotinine, could have helped the current study better define the effectiveness of a home smoking ban on reducing exposure to ETS.

Studies using intensive counseling interventions have demonstrated positive results in controlled attempts to reduce asthmatic children's exposure to ETS. Behavioral counseling to modify residential smoking patterns has been shown to be an effective means of reducing ETS exposure in a study of asthmatic children.^{17,18} A follow-up of one of these studies demonstrated long-term parental smoking cessation.¹⁹ These interventions were conducted by a single group of investigators, used intensive counseling, and would be difficult to achieve outside of a research setting. Parents were the focus of counseling for these studies, and these interventions would not be expected to influence nonparental sources of ETS.

Several investigators have developed brief interventions to reduce children's exposure to ETS.^{13,20-22} These studies have used a variety of methods including an educational program for parents,¹³ a phone call and letter from pediatrician to parent,²² and brief advice on smoking cessation.^{20,21} As in most ETS intervention studies, parents were the targets of the smoking intervention. Reduction in children's ETS exposure was not reported in any of these studies, although some positive effects were reported. Groner et al²⁰ found that intervention group mothers were significantly more likely to report smoking outside, although this was not a focus of the intervention. A study by Irvine et al,²¹ which did encourage parents to smoke in a different room or outside, showed a nonsignificant trend toward less smoking in the presence of the child. Given the difficulty in reducing children's ETS exposure from parental sources, addressing nonparental smoking is expected to be a greater challenge.

Our survey found a very high level of belief that smoking is bad for health and harmful to children. There was stronger belief about the harmful effects of smoking in this survey than was found in previous work of both smoking and nonsmoking parents.^{9,23} The beliefs described in this sample may reflect growing knowledge among the population of the harmful effects of secondhand smoke. We did not ask caregivers of smoke-exposed children whether they believe that tobacco smoke might be harmful to these children.

Caregivers' interest in receiving advice from pediatricians on smoking cessation was studied in this survey and compared with past reports. In our study, approximately one half of caregivers who smoke reported interest in receiving advice from the pediatrician on quitting smoking or helping others quit. In previous work, from 49% to 93% of smoking parents have agreed that it is appropriate for their child's pediatrician to provide smoking cessation advice.^{9,23,24} Our findings are comparable with these studies, although our sample size is small. Further work should explore characteristics of smoking caregivers that predict interest in receiving cessation advice. Successful interventions may require tailoring based on readiness to quit smoking.

Among nonsmoking caregivers, there was a varying degree of interest in receiving advice on helping others quit smoking. For children who live with a smoker, younger caregivers were less likely to be interested in receiving advice on helping others quit smoking. These younger caregivers may believe that they have little ability to influence the smoking status of a household, particularly if they are not the primary owner/renter. Although past work has focused on correlates of residential smoking restrictions, little is known about parental interest in methods of reducing children's exposure to ETS.^{25,26} The high level of caregiver interest in helping others quit smoking may reflect an unmet need of the study population. It is unclear why pediatric residents in this practice seem to be assessing the degree of ETS exposure (75.9%) but not providing an equal level of advice for caregivers. Residents may perceive that many children in our population are smoke-exposed and may recognize that the source of exposure may not be with the child at the office visit. Strategies for all physicians to address this problem are needed.

Reducing a child's direct (in-room) exposure to ETS may be a practical solution to the problem of pediatric ETS exposure and may have the most significant impact on pediatric illness. Past work suggests that the most significant health burden of ETS may come from smoking in close proximity to the child.^{3,11} A prospective study of 485 infants in North Carolina found that the number of cigarettes smoked per day in the presence of the child was the best predictor of lower respiratory illness.²⁷ Irvine et al¹¹ found that urine cotinine levels are dependent on the proximity of smoking to the child. A dose-response relationship has been noted in systematic reviews of the literature on the association between parental smoking and childhood asthma and lower respiratory illness.^{28,29}

Advice from pediatricians to parents about ETS does not seem to be as widespread as concern about the effects of ETS.^{2,9,23,30} This apparent disconnect may be the result of many barriers. Barriers to reducing ETS exposure described in previous literature include lack of time, lack of skills, and the perception that parents are unwilling to change behavior or do not want counseling from the pediatrician on smoking cessation.^{7-9,30} This and other studies show that at least one half of smoking caregivers would like help in quitting. Pediatricians may be encouraged

that knowledge of the harmful effects of secondhand smoke seems to be high. Another barrier to reducing ETS exposure may include inability to address nonparental and nonresidential sources of ETS. An emphasis on parental smoking cessation, as opposed to reduction of exposure, may have created additional burden for providers.

This study is not intended to describe the prevalence of ETS exposure in this pediatric practice. The true prevalence of smoke exposure in the home would require both a random sample and a description of the numbers of all children and adolescents in each home. The unit of analysis for this study was 1 child per caregiver to simplify the caregiver's ability to quantify a child's degree of smoke exposure. Biomarkers, such as cotinine, would be useful for determining the true prevalence of ETS exposure. Further work to address the relation between exposure outside the home and biochemical evidence of tobacco exposure is needed for urban children.¹²

Pediatricians recognize the dangers of exposure to ETS but are missing opportunities to intervene, particularly with parental smoking cessation.^{7,30} Given the difficulty that pediatricians have had in assisting parental smoking cessation, the task of addressing nonparental sources of exposure may seem insurmountable. Nonparental sources of tobacco smoke exposure may be common for poor urban children. Although smoking cessation among caregivers is optimal, any reduction in tobacco smoke exposure may reduce harm to children. As currently practiced, home smoking restrictions do not eliminate a child's exposure to ETS. Increasing awareness of the importance of home smoking restrictions and reduction of smoking in the presence of the child should be explored as strategies for pediatricians to motivate caregivers to reduce children's exposure to ETS. Caregivers' interest in receiving advice may need to be considered in tailoring interventions.

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