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Family Composition and Children's Exposure to Adult Smokers in Their Homes:

Family Composition and Children's Exposure to Adult Smokers

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Abstract

Background—Smoking behavior is strongly influenced by the social environment. More information is needed about how the composition of households with children is associated with adult smoking behavior so that more effective interventions to reduce children's secondhand smoke exposure can be devised and implemented.

Methods—Using data from the Medical Expenditure Panel Survey 2000-2004, we conducted cross-sectional analyses assessing how adult smoking behavior is associated with household characteristics, including the number of adults and smokers present, the relationship of the child to the head of household and relationships between adult members of the household.

Results—Over a third of children (34.4%) live with >1 adult smoker. Almost half of poor children (49.4%) live with a smoker, and they are more likely to live with multiple smokers compared to those living > 400% of poverty (21.2% vs. 7.8%, $p<0.001$). Approximately 5 million children live in households headed by an adult other than their parent, and they are significantly more likely to live with smokers: 53.4% of children living in their grandparents' homes and 46.2% of children in homes of other adults live with at least one adult smoker, compared to 33.3% living in their parents' home ($p<0.001$). 59.4% of all children who live with a smoker have a smoking mother, and 56.7% of these children live with > 2 smokers, whereas only 17.0% of children whose mothers do not smoke have smoking adults in the home.

Conclusions—These findings demonstrate the significant influence of household composition on children's likelihood to live in homes with adult smokers.

Keywords

environmental tobacco smoke; family context; disparities; smoking

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Smoking is the leading preventable cause of death in the United States. Secondhand smoke (SHS) exposure has numerous adverse effects on child health, including higher rates of low birth weight, Sudden Infant Death Syndrome, respiratory infections, recurrent otitis media, and increasing asthma severity.¹⁻⁸ A growing epidemiologic literature demonstrates that children's SHS exposure is associated with many other problems, including Attention-Deficit Hyperactivity Disorder,⁹ behavioral problems,¹⁰ dental caries,¹¹ food insecurity,¹² and the Metabolic Syndrome.¹³

Children's households are the most significant site of their SHS exposure, and more than 30% of U.S. children live in a household with at least one smoker.¹⁴⁻²⁰ There is no safe level of exposure to SHS.⁴ While there has been a substantial increase in the use of household rules to restrict children's exposure to tobacco smoke, even when these rules are consistently enforced, children living with smokers have significantly increased levels of toxic exposure.^{4,21,22}

With growing concern about the serious adverse consequences of children's SHS exposure, there has been increasing discussion, research, and policy development aimed at reducing children's exposure at home and elsewhere, and helping parents quit smoking.²³⁻³¹ However, the dynamics of smoking in social networks suggests that smoking cessation in one person is relevant to other household members, and as a result, to maximize tobacco control for children, interventions will have to be sensitive to the complexities of the family environment in households with children.³² Using nationally representative data, this study investigates child and household characteristics associated with children living with one or more adult smokers and assesses which adults in children's homes are most likely to smoke.

Methods

Data source

Data from the Medical Expenditure Panel Survey (MEPS), a nationally representative survey of the civilian, non-institutionalized US population, sponsored by the Agency for Healthcare Research and Quality and the National Center for Health Statistics were used. Data from 2000-2004 were concatenated, resulting in a final sample of 46,982 children age 0-18 years, living in 23,338 households with 52,337 adults.

Variables

A household consists of all adults and children living in a housing unit regardless of their relationship to one another. All adults living in the particular household were included when assessing household characteristics.

Smoking status for each adult household member was ascertained from the self-administered questionnaire section of the MEPS, which is given to each member of participating households >18 years, and asks of the respondent "Do you currently smoke?" For adults for whom data on smoking status was not reported (14% 2000-2004), smoking status was imputed using a two-stage procedure.

The first stage of the imputation utilized the two-year structure of MEPS, assigning the smoking status reported in one year to the smoking status in the year not reported. The strategy was validated using the 2003 and 2004 MEPS. For adults participating in the survey in both 2003 and 2004 and who reported their smoking status in each year, 93.5% did not change their smoking status between years. Among the 6.5% who did change, there was near balance between those who quit smoking (3.4%) and those who began (3.0%). The second stage of the procedure imputed values for those adults who did not report their smoking in either year of participation by applying an algorithm using variables associated with smoking status developed by the Agency for Healthcare Research and Quality.¹⁶ 32.3% of the missing values were imputed during the first stage of the model, 67.7% in the second.

For each household, MEPS identifies a reference person as the head of household. The head of household is the household member, >16 years, who owns or rents the home. If more than one person meets this description, members of the household determine who is designated its head. The head of household is the primary respondent for the survey, and all relationships are identified in relation to him/her.

Relationships between participating children and heads of household were divided into three categories. The head of the household was designated a “parent” if they were a participating child’s biological or adoptive parent, or the significant other of a child’s parent, regardless of whether they were or were not married to the child’s biological or adopted parent. The head of the household was designated a “grandparent” if the participating child was identified as their grandchild or great grandchild. Heads of household who had any other relationship to the child were identified as “other adult relatives”

Relationships between the head of the household and other adults in the home were then divided into four categories. “Spouse” refers to any adult in the home who is identified as the wife, husband or partner of the head of household, regardless of marital status. Alternatively, in this context “parent” refers to the mother or father of the head of household, and “adult child” refers to adults who are identified as the daughter or son of the head of household. All other relationships between adult members of the household and the head of household were classified as “other adult relative.”

Analyses

Potential associations between child and household characteristics with the presence of a smoking adult were assessed using bivariate and multivariable analyses. Bivariate analyses investigated the association between the child and household characteristics with the presence and number of smoking adults in the home. Multivariable analyses elucidated the relationship between household characteristics and adult smoking behavior. Potential covariates showing at least a moderate association ($p < 0.10$) with the presence of smoking adults in the home were included in the model.

A second series of analyses assessed the relationship between household characteristics and adult smoking behavior using bivariate analyses.

All analyses were conducted and weighted using SUDAAN software to adjust for the complex sampling design (Research Triangle Institute, Cary, NC).

Results

Child, Family and Household Characteristics and Children's Risk of Living With One or More Adult Smokers

34.4% of U.S. children live in homes with at least one adult smoker, and as shown in Table 1, the likelihood that a child lives with one or more adult smokers varies significantly depending on the characteristics of the child and family in which he/she lives. Children in lower income households are substantially more likely to live with a smoking adult and with multiple smokers. Children living in homes below the Federal Poverty Line (FPL) are more than twice as likely to live with one or more adult smokers and nearly three times as likely to live with 2 or more adult smokers than are children in households with incomes >400% FPL (49.4% vs. 21.3%, and 21.1% vs. 7.8%, respectively, $P<0.0001$ for each comparison). Black and White children both are more likely to live with >1 adult smoker than are Hispanic and Asian/Pacific Islander children ($p<0.001$). Nevertheless, almost 30% of Hispanic and 25% of Asian-Pacific children live in homes with smokers.

Children living in households headed by an adult who is not their parent ("non-parental homes") are significantly more likely to live with a smoking adult, and to live with multiple smoking adults than are children who live in homes headed by one of their parents ("parental homes") (Table 1). More than half, 53.4%, of children living in their grandparents' homes live with >1 adult smoker as do 46.2% of children living in the homes of other adult relatives, compared to 33.3% of children in parental homes ($p<0.0001$; $p<0.0001$, grandparent and other-adult relative homes, respectively). Children living in non-parental homes also are more likely to live with multiple adult smokers than are children in parental homes ($p<0.0001$, $p<0.0001$, grandparent and other-adult relative homes, respectively).

As shown in Table 2, children living in poverty and those who belong to a minority race/ethnicity are more likely to live in non-parentally headed households ($p<0.0001$, $p<0.0001$). Not shown in tabular form is the fact that children living in non-parental homes are also significantly more likely to live with >3 adults ($p<0.001$), with homes headed by grandparents or other adult relatives nearly 3 times more likely to have > 3 adults (59.7%, 56.6% and 20.0%, respectively, $p<0.001$).

Table 3 shows child and household characteristics independently associated with the likelihood of living with one or more smokers. The number of adults in the home emerges as a significant independent risk with children living with >3 adults 220% more likely to live with a smoking adult (AOR 2.21, 95% CI: 2.00-2.43). In contrast, children living with only one adult are less likely to live with a smoking adult (AOR=0.85, CI: 0.75-0.96). While Black children live in homes with adult smokers in the same proportion as White children, after controlling for family income and the number of adults in the home, Black children are less likely to live with a smoker (AOR=0.62, CI: 0.63-0.80), which also is true for Hispanic and Asian/Pacific Islander children. Lower household income is associated with an

increased risk for a child to live with an adult smoker at all income categories below 400% FPL.

Identity of adult smokers in households with children

Adults in the United States are more likely to smoke when they live with children than when they do not (23.4%, 21.4%; $p<0.001$) (data not shown in tabular form). The majority of smokers living with children are either the head of the household or his/her spouse (83.3%). An additional 11.4% of adult smokers in homes with children are the adult children of the head of household. The majority of these adult children (83.2%) do not have children of their own in the home, suggesting that they are largely adult siblings of children in the home. Parents of the head of household and other adult relatives are a small proportion of smokers in households with children (1.1% and 1.2%, respectively).

In households with three or more adults, the heads of household or their spouse again constitute the majority of smokers (71.3%). However, there are significantly more adult children of the head of house who smoke in these homes (24.1%), and there are more adult children who smoke in these homes than there are spouses who smoke.

Parental Smoking

20.0% of children live with a smoking mother and 17.9% live with a smoking father (data not shown in tabular form). 59.4% of children living with smokers live with a smoking mother. In smoking households, the child's mother is the only smoker in 23.3% of households, and the father is the only smoker in 25.2% of households. In 16.0% of smoking households, neither the mother nor father smokes.

Both maternal and paternal smoking is highly associated with the smoking behavior of other adults in the home (Table 4). 56.7% of children who live with a smoking mother and 51.6% who live with a smoking father live with additional smokers. Similarly, 44.7% of children living with a smoking mother also live with a smoking father (data not shown in tabular form). In contrast, 83.0% of children living with a non-smoking mother and 90.6% living with a non-smoking father live with no smoking adults.

Discussion

These nationally representative data provide a comprehensive view of which children in the United States are likely to live with adult smokers and who the adult smokers are in these households. 34.4% of children live with a smoking adult. This rate is consistent with rates found in other studies and is nearly five times higher than the rate of non-smoking adults who live with smokers (7%).^{4, 14-20} The dominant risk factors for a child to live with a smoker is household poverty and increasing numbers of adults in the home. In fact, nearly 50% of children below the Federal Poverty Line live with >1 adult smoker, and children in homes with >3 adults are more than twice as likely than children in homes with two adults to live with an adult smoker.

These data also draw attention to the complexity of our nation's children's living circumstances and begin to elucidate the strong associations between these complexities and

children's exposure to SHS. Children not only live in homes with many non-parental adults, a good number of whom smoke, but they also often live in homes where their parents are not the head of the household, potentially limiting their parents' authority about household rules in ways that are not yet clear. Moreover, nearly twice as many children in America live with three or more adults than with a single adult. Previous research has suggested an association between three-adult homes and children's exposure to SHS in bivariate analyses.¹⁶ To the best of our knowledge, however, the current study is the first to establish that >3 adults in the home is an independent risk and to elucidate the specific characteristics of these homes. In particular, >3 adult homes are not only more likely to contain a smoker, but they are also more likely to contain multiple smokers, be headed by a non-parental adult, contain non-White children, and be relatively poor.

The complexity of children's homes argues that asking about a mother's smoking status at a child's medical visit is insufficient to assess the child's risk for household SHS exposure and to offer effective counseling. The majority of mothers who smoke live with other smokers, and a substantial proportion live with >2 other smokers. In contrast, 17.0% of children living with a non-smoking mother still have a smoking adult in the home. Moreover, as found in previous studies, even in homes with no smoking resident there is considerable smoking by visitors, and in 25% of these homes, the visitors smoke every day.¹⁴

The Surgeon General's Report concluded that there was no safe level of exposure to SHS.⁴ The presence of any adult smokers in the home exposes all family members to increased morbidity and mortality,³³ risk of house fire,³⁴ and the chance that the child will become a smoker,³⁵ while decreasing the financial resources of the household.³⁶ An important strategy to reduce children's household SHS exposure is the counseling of parents during children's visits to health care providers. Brief clinician counseling interventions for parental smoking cessation and SHS reduction has some influence on parental smoking behavior and reducing children's household SHS exposure as measured by household nicotine, increasing parental reports of smoke-free homes, and parental quit attempts.^{23, 24} The importance of this preventive intervention has been recognized by the American Academy of Pediatrics,²⁵ American Academy of Family Physicians,²⁶ American Medical Association,³¹ Public Health Service Guidelines,^{23,24} Maternal and Child Health Bureau Bright Futures Guidelines,²⁷ and Healthy People 2010.²⁸

These guidelines all emphasize counseling parents, but only the American Academy of Pediatrics guidelines recognize the need to assess the smoking behavior of other adults in the home. The current findings support this emphasis on parental smoking and reinforce the importance of acting on these existing guidelines to ensure that parents have every support available to change their smoking behavior.

These data also indicate that there is need for significantly more research into smoking behavior at the family level. The vast majority of research into the influence of family context on adult smoking behavior has looked at concordance in the smoking behavior of partners.^{32,37,38} Notably, however, previous research has not investigated the influence of other, non-partner smoking adults on smoking cessation and SHS reduction efforts. The current findings suggest that there is a need to address these questions and explore how the

presence of other adults as well as distinct family roles influence the success of smoking cessation attempts and efforts to reduce children's household SHS exposure. In addition it also points to the need to develop strategies that can help parents in these complex family environments reduce their children's exposure in these complex families.

MEPS data provide a longitudinal perspective on a nationally representative sample of households. This structure facilitates the imputation model employed to address the non-response rates for adult smoking status questions. While its large size allows for national estimates for many populations, there are some populations of interest that are not present in sufficient number to facilitate independent analysis, for example, we were unable to perform independent analyses of foster children or American Indian/Alaska Native children.

Because interviews are conducted in the participant's households over two years, the interviewer also has the opportunity to develop a rapport with participants, increasing their willingness to share sensitive information. However, MEPS does not collect data that would allow us to further quantify children's exposure to SHS, such as how often smoking occurs in the home. Moreover, it does not collect data on teenage smoking, and as a result the current estimates do not include the contribution of this population to the exposure of other children to household SHS.

A number of previous studies have looked at the association between household smoking behavior and household characteristics. Schuster and colleagues found that homes with at least two adults had less regular smoking in the home than single adult households and that father only homes had less regular smoking than mother only homes.¹⁴ Other studies, looking specifically at smoking bans, have found homes with children, non-smoking adults, male smokers, younger smokers, or Hispanic and Asian households are all more likely to report smoke-free home rules.³⁹⁻⁴³ While smoking bans have become increasingly prominent in children's homes, they are less consistently enforced when there are two or more adults or children present in the home, and even when consistently enforced, children still have increased levels of toxic exposure, and so this approach currently offers incomplete protection for children in these homes.^{4,21,22,44}

Conclusion

Over the last 20 years, public smoking bans have led to the protection of large numbers of adults from SHS exposure. Children, however, are exposed primarily in the home, and so remain exposed to SHS at consistently high levels. The large number of children living with smokers, along with the complexity of the homes in which these children live reinforces the urgent need for strategies to help protect children from the harms of exposure to adult tobacco use.

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Abbreviations used

SHS	(Secondhand Smoke)
MEPS	(Medical Expenditure Panel Survey)
FPL	(Federal Poverty Line)

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Table 1

Percentage of Children Living With Smoking Adults by Characteristics of Children and Household, MEPS 2000-2004 (n = 46,982)

	Smokers in Household			
	0	1	2	3+
Family Income ^{*(a)}				
<100% FPL	50.6	28.2	14.5	6.6
100%-125% FPL	55.8	26.8	13.1	4.3
125-200% FPL	61.2	22.6	13.2	3.0
200%-400% FPL	65.9	19.8	11.6	2.7
>400% FPL	78.7	13.5	6.7	1.1
Race/ethnicity of child ^{*(b)}				
White (non-Hispanic)	63.7	20.1	13.0	3.3
Black (non-Hispanic)	63.9	24.0	9.1	3.0
Hispanic	72.5	18.0	6.8	2.7
Asian-Pacific Islander	77.7	15.8	5.5	1.1
Relationship of Head of Household to Child ^{*(c)}				
Parent	66.7	19.9	10.8	2.6
Grandparent	46.6	26.6	17.3	9.5
Other adult*	53.8	26.6	11.7	7.8
Total	65.6	20.3	11.1	3.0

^{*(a)} p<0.0001 for each comparison of the percentage of homes with children who (a) live with one or more adult and (b) multiple adult smokers, households with children <100% Federal Poverty Line (FPL) vs >400% Federal Poverty Line

^{*(b)} p<0.001 for each comparison of the percentage of homes with (a) one or more adult and (b) 2 or more adult smokers, (1) Hispanic and (2) Asian/Pacific Islander children compared with White children

^{*(c)} p<0.0001 for each comparison of the percentage of homes with (a) one or more adult and (b) 2 or more adult smokers, households headed by (1) grandparents and (2) by other adults compared with households with children headed by the children's parents

Table 2

Characteristics of Children and Households by Relationship of Head of Household to Child, MEPS 2000 – 2004 (n=46,982)

	Parental Homes	Grandparental Homes	Other Adult Relative Homes
Total	93.8	4.9	1.3
Family Income ^{*(a)}			
<100% FPL	89.69	8.03	2.28
100%-125% FPL	90.10	7.89	2.00
125-200% FPL	91.74	6.65	1.60
200%-400% FPL	94.35	4.36	1.28
>400% FPL	97.34	2.05	0.62
Race/ethnicity of child ^{*(b)}			
White (non-Hispanic)	96.44	2.96	0.59
Black (non-Hispanic)	86.15	10.97	2.88
Hispanic	91.31	6.28	2.41
Asian/Pacific Islander	93.64	4.05	2.32
Number of Adults in home			
1	95.12	3.65	1.24
2	97.03	2.31	0.66
3+	83.76	12.92	3.32

^{*(a)} p<0.0001 for family income vs % of children living in parent headed incomes

^{*(b)} p<0.0001 for % of Black, Hispanic or Asian/Pacific Islander vs White households with children that are parent-headed

Table 3

Adjusted Odds Ratio of Living With a Smoker by Household Characteristic, MEPS 2000 - 2004 (n=46,982)

Characteristic	AOR	95% CI	p-value
Family Income			
<100% FPL	4.93	4.28-5.67	0.000
100%-125% FPL	3.88	3.21-4.68	0.001
125-200% FPL	2.82	2.47-3.21	0.000
200%-400% FPL	2.02	1.82-2.24	0.000
>400% FPL	1.00	-	-
Race/ethnicity			
White	1.00	-	-
Black	0.62*	0.55-0.70	
Hispanic	0.41*	0.36-0.46	0.000
Asian PI	0.47*	0.37-0.60	0.000
Census Region			
Northeast	1.00	-	-
Midwest	1.04	0.89-1.21	0.590
South	0.99	0.87-1.14	0.862
West	0.66*	0.57-0.77	0.000
Adults in Household			
1	0.85*	0.75-0.96	0.014
2	1.00	-	-
3+	2.21*	2.00-2.43	0.000
Head of Household's Relationship to Child			
Parent	0.75	0.56-1.00	0.052
Grandparent	1.22	0.89-1.66	0.213
Other adult family member	1.00	-	-

Table 4

Proportion of Children Living With One or More Adult Smokers by Parental Smoking Status, MEPS 2000 - 2004 (n=46,982)

Number of Smoking Adults in Home		0	1	2	3+
Mother	Smoker	0.0	43.3	45.4	11.3
	Non-Smoker	83.0	14.1	2.2	0.7
Father	Smoker	0.0	48.4	42.4	9.2
	Non-Smoker	90.6	7.9	1.3	0.3