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# Parents Smoking in Their Cars With Children Present

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## KEY WORDS

parents, pediatrics, secondhand smoke, smoking in car, tobacco control, tobacco smoke

## ABBREVIATIONS

AAP—American Academy of Pediatrics  
CI—confidence interval  
OR—odds ratio  
PROS—Pediatric Research in Office Settings  
TSE—tobacco smoke exposure

Dr Nabi-Burza conceived of and designed this article, drafted the manuscript and revised it, and takes full responsibility for the final submission; Dr Regan advised on and conducted data analyses and participated in the interpretation of results; Dr Winickoff conceived of and conducted the larger trial as the principal investigator; and all coauthors had full access to all of the data in the study and made substantial intellectual contributions to the conception and design, analysis and interpretation of data, editing the manuscript, and approving the final version for publication.

This trial has been registered at [www.clinicaltrials.gov](http://www.clinicaltrials.gov) (identifier NCT00664261).

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**WHAT'S KNOWN ON THIS SUBJECT:** Tobacco smoke exposure is associated with increased morbidity in children, and exposure in cars can be particularly intense. The American Academy of Pediatrics policy statement recommends that pediatricians assist families in adopting smoke-free car policies.



**WHAT THIS STUDY ADDS:** In this study, few smoking parents had a strictly enforced smoke-free car policy. Low rates of pediatric health care providers addressing smoking in the car highlights the need for improved pediatric interventions to protect children from tobacco smoke toxins.

## abstract



**OBJECTIVE:** To determine prevalence and factors associated with strictly enforced smoke-free car policies among smoking parents.

**METHODS:** As part of a cluster, randomized controlled trial addressing parental smoking, exit interviews were conducted with parents whose children were seen in 10 control pediatric practices. Parents who smoked were asked about smoking behaviors in their car and receipt of smoke-free car advice at the visit. Parents were considered to have a “strictly enforced smoke-free car policy” if they reported having a smoke-free car policy and nobody had smoked in their car within the past 3 months.

**RESULTS:** Of 981 smoking parents, 817 (83%) had a car; of these, 795 parents answered questions about their car smoking policy. Of these 795 parents, 29% reported having a smoke-free car policy, and 24% had a strictly enforced smoke-free car policy. Of the 562 parents without a smoke-free car policy, 48% reported that smoking occurred with children present. Few parents who smoke (12%) were advised to have a smoke-free car. Multivariable logistic regression controlling for parent age, gender, education, and race showed that having a younger child and smoking  $\leq 10$  cigarettes per day were associated with having a strictly enforced smoke-free car policy.

**CONCLUSIONS:** The majority of smoking parents exposed their children to tobacco smoke in cars. Coupled with the finding of low rates of pediatricians addressing smoking in cars, this study highlights the need for improved pediatric interventions, public health campaigns, and policies regarding smoke-free car laws to protect children from tobacco smoke. *Pediatrics* 2012;130:e1471–e1478

According to the 2010 Surgeon General's report, there is "no safe level" of tobacco smoke exposure (TSE)<sup>1</sup>; thus, implementing 100% smoke-free policies is the only way to protect children and their families against the harms of TSE. Tobacco smoke is a well-documented toxic air contaminant that contributes to increased morbidity and mortality in children. It leads to a greater likelihood of lower respiratory infections,<sup>2-4</sup> sudden infant death syndrome,<sup>5,6</sup> and ear infections,<sup>7</sup> and it increases the severity of asthma symptoms.<sup>8,9</sup> In 1992, the US Environmental Protection Agency concluded that TSE is a "group A" carcinogen, a substance that has been established as a definitive cause of cancer in humans.<sup>10</sup>

An estimated 88 million nonsmoking Americans, including 54% of children aged 3 to 11 years, were exposed to tobacco smoke in 2007 and 2008.<sup>11</sup> In children aged  $\leq 18$  months, TSE is responsible for an estimated 150 000 to 300 000 new cases of bronchiolitis and pneumonia annually and  $\sim 7500$  to 15 000 hospitalizations annually in the United States.<sup>10</sup> Homes have traditionally been considered the main indoor source of tobacco smoke contaminants for children,<sup>12,13</sup> but recent studies have shown that private passenger vehicles (hereafter referred to as cars) are an important domestic environment with the potential for elevated levels of tobacco smoke contamination under normal conditions of use.<sup>14-18</sup> These studies demonstrated that concentrations of PM<sub>2.5</sub> (particulate matter with a diameter  $< 2.5 \mu\text{m}$ ) can exceed the limits recommended by the US Environmental Protection Agency<sup>19</sup> and World Health Organization<sup>20</sup> in cars where people smoke. Even with ventilation, tobacco smoke pollution levels in cars remain high,<sup>21</sup> and at least 1 study has demonstrated that air quality in a car with a window partially or completely down is similar to that of

a typical smoky bar.<sup>22</sup> These findings led the British Medical Association to urge the government to ban smoking in cars at all times to protect people from the risk of TSE.<sup>23</sup>

Despite the proven harms of TSE,<sup>6,7</sup> many parents overlook its dangers and smoke in their cars, thus exposing their children to high concentrations of secondhand smoke. Furthermore, third-hand smoke toxins, defined as residual tobacco smoke contamination that remains after the cigarette is extinguished, have also been shown to remain on surfaces wherever cigarettes are smoked, including in cars.<sup>12,24-26</sup> In addition, studies have shown that smoking initiation early in life is associated with having been exposed to tobacco smoke in cars, adding to the importance of implementing strict smoke-free car policies.<sup>27</sup>

The best way to protect children from the harms of TSE is for parents to quit smoking, but even parents who cannot quit can reduce their children's exposure by implementing 100% smoke-free home and car policies.<sup>28</sup> The pediatric health care setting provides a unique teachable moment to motivate and help parents quit smoking.<sup>29-33</sup> American Academy of Pediatrics (AAP) guidelines also recommend that pediatricians assist families with tobacco-use prevention and treatment.<sup>34</sup> Although some researchers have examined smoking in cars,<sup>35-37</sup> no previous studies have examined rates of counseling for smoke-free cars in the immediate context of a pediatric visit, and few have studied the correlates of parental smoking in cars.<sup>35-40</sup> The primary aims of the current study were to determine the prevalence of parents smoking in their cars with children present and to determine how often pediatric health care providers advise parents to have smoke-free cars. Further aims included identifying parent and child characteristics

related to parents enforcing a strict smoke-free car policy. Identifying and understanding these characteristics will help design better smoking cessation interventions for pediatric offices that identify children at risk and reduce TSE in children as early as possible.

## METHODS

We analyzed baseline data collected at pediatric practices enrolled in the control arm of a cluster, randomized controlled trial, Clinical Effort Against Secondhand Smoke Exposure. This trial tested the implementation of an intervention to address parental tobacco use in the pediatric office setting. The study was conducted in partnership with the Pediatric Research in Office Settings (PROS),<sup>41</sup> which is the practice-based research network of the AAP. Twenty practices were recruited and randomized, 10 each to the intervention and control arms. The 10 control practices were located in 8 states (AK, CT, MO, NM, PA, SC, TN, and VA). Participants were eligible to enroll in the study if they had accompanied a child to the office visit, had smoked at least a puff of a cigarette in the past 7 days, were the parent or legal guardian of the child seen that day, were at least 18 years old, and spoke English. The study protocol was approved by the institutional review boards of the AAP and Massachusetts General Hospital and by individual practice institutional review boards where required.

## Participant Enrollment

At each practice, 1 or more research assistants were stationed at the exit and administered a screening questionnaire to all adults (smoking and nonsmoking) at the end of their child's visit. If the adult was eligible, the research assistant obtained written informed consent and administered a baseline enrollment survey to the parents/legal guardians (hereafter

referred to as parents). These enrolled parents received \$5 in cash for completing the baseline enrollment survey. Screening continued until 100 eligible parents were enrolled at each practice. The screening questionnaire was used to gather demographic information: parent's age, gender, race and ethnicity, and level of education (high school or less versus some college or college graduates); the age of the youngest child present at the visit; reason for the visit (routine well-child visit, sick visit, or other reason); and how the visit was paid for (private insurance, Medicaid, self-pay, or some other method). The baseline enrollment survey assessed smoking behaviors in more detail, including the parent's smoking level (cigarettes per day) and readiness to quit.

Enrolled parents who reported having a car were asked several items focused on smoking behavior and policy. Parents were asked to select the statement that best described their car smoking policy: (1) no one is allowed to smoke in my car; (2) people are allowed to smoke in my car; or (3) other. Car smoking behavior was assessed according to the question: "In the past 3 months, has anyone smoked in your car, even a puff?" If the parent reported that smoking was allowed in their car, the research assistant asked this additional question: "How often do people smoke in your car when there is a child present?" The answer options were never, rarely, sometimes, or often.

Parents were also asked questions about their home smoking behavior and policy. Parents were asked to select the statement that best described their home smoking policy: (1) no one is allowed to smoke anywhere; (2) smoking is permitted in some places or at some times; or (3) smoking is permitted anywhere. Home smoking behavior was assessed according to the question "During the past 3 months, has anyone

smoked anywhere in your home, even a puff?"

Parents were asked a series of questions to determine if smoking behaviors or policies were discussed during their visit at the pediatric office: "At any time in your visit today did anyone ask if you": (1) smoke cigarettes; (2) have a smoke-free car; or (3) have a smoke-free home. In addition, enrolled parents were asked if, during their visit, their child's health care provider advised them to: (1) stop smoking; (2) have a smoke-free car; or (3) have a smoke-free home.

### Statistical Analysis

The primary study outcome was having a "strictly enforced smoke-free car policy." Parents were considered to have a strictly enforced smoke-free car policy if they reported having a smoke-free car policy and that no one had smoked in their car for the past 3 months. Analyses were limited to parents who reported having a car that they owned or traveled in frequently. To study any association between parental smoking behaviors at home and in the car, we also looked at the number of parents who had a "strictly enforced smoke-free home policy." Parents were considered as having a strictly enforced smoke-free home policy if they reported having a smoke-free home policy and that no one had smoked in their home for the past 3 months. To examine counseling of parents about having smoke-free cars, a stratified analysis was conducted on the parents who reported smoking in their cars with children present, and we examined the percentage of providers who gave advice regarding having a smoke-free car at that day's visit. Furthermore, we examined the association between the age of the child and the type of visit with pediatricians addressing smoke-free cars with parents.

Bivariate analyses were conducted by using  $\chi^2$  tests to explore the association between parent and child characteristics and having a strictly enforced smoke-free car policy. Parents were excluded from the bivariate and multivariate analyses who did not answer questions about smoking policy in their car. Parent's age, gender, education, and race were included in the logistic regression model as control variables along with other variables that were significant at  $P < .05$  in the bivariate analysis and had theoretical plausibility. Odds ratios (ORs) and 95% confidence intervals (CIs) were reported for each variable from the final model. In the multivariable model, robust SEs were used to adjust for clustering of parents within practices. In exploratory analyses, we tested interactions between the parent demographic variables and the other significant predictors. We present a final model that includes significant interaction terms.

Model fit was assessed with the C statistic. All  $P$  values are 2-sided, and they were considered significant at  $< .05$ . All analyses were conducted by using Stata version 10 (Stata Corp, College Station, TX).

### RESULTS

Of the total 981 parents who were enrolled in 10 PROS control practices, 817 reported having a car. The majority (70%) of the parents were in the age group 25 to 44 years, 77% were females, mostly mothers (98% vs 2% legal guardians), and 68% were non-Hispanic whites. Many parents (42%) had only a high school degree, and 16% had completed college. Most of the children (60%) were covered by Medicaid (Table 1).

Of the 817 parents who reported having a car, 795 answered questions about their car smoking policy. Of these 795 parents, 73% reported that someone had smoked in their car in the past 3 months (Table 2). Fewer than 1 in 3

**TABLE 1** Parent Characteristics (*N* = 817)

Variable	<i>N</i> (%)
Age, y	
18–24	190 (23)
25–44	573 (70)
45–64	54 (7)
Gender	
Male	185 (23)
Female	632 (77)
Race and ethnicity	
Hispanic (any race)	106 (13)
White	554 (68)
Black or African American	118 (14)
Others	39 (5)
Education	
<High school	99 (12)
High school graduate	346 (42)
Some college	240 (29)
College graduate	130 (16)
Other smokers in home	
Yes	474 (58)
No	343 (42)
Youngest child's age, y	
<1	214 (26)
1–4	288 (35)
5–9	158 (19)
≥10	147 (18)
Child's insurance coverage	
Medicaid	488 (60)
Private insurance/HMO	257 (31)
Other/self-pay	72 (9)

HMO, health maintenance organization.

parents (29%) reported having a smoke-free car policy, and only 24% reported having a strictly enforced smoke-free car policy, which is less than one-half the parents who reported having a strictly enforced smoke-free home policy (57%). There was some geographic variability in the number of parents reporting strictly enforced smoke-free car policies across the 8 states. It ranged from 16% in Virginia (mean of 3 practices) to 39% in Connecticut; the other states were as follows: Tennessee, 17%; Missouri, 23%; New Mexico, 24%; Pennsylvania, 28%; South Carolina, 31%; and Alaska, 33%. Eighty-two percent of parents who reported having a strictly enforced smoke-free car policy also reported having a strictly enforced smoke-free home policy. However, the majority (66%) of those with a smoke-free home policy do not have a strictly enforced smoke-free car policy. Almost 1 in 5

parents who had a smoke-free car policy reported that it was violated in the past 3 months. Of the 562 parents who did not report having a smoke-free car policy, 48% reported that smoking occurred with children present in the car.

Approximately one-fifth of all enrolled parents reported being asked by a pediatric health care provider about their smoking status (Table 2). Only 14% of smoking parents reported being asked if they had a smoke-free car, and even fewer (12%) reported being advised to have a smoke-free car policy by a pediatric health care provider. Of those who smoked with children present in the car, only 5% were counseled about having a smoke-free car. Of those who were advised to have a smoke-free car policy, 54% identified the reason for the visit as a routine well-child visit and 34% as a sick visit.

Bivariate analysis (Table 3) showed that having a child <1 year old and smoking fewer cigarettes per day were as-

sociated with having a strictly enforced smoke-free car policy. Having another smoker at home was associated with a lower likelihood of having a strictly enforced smoke-free car policy. We did not find any association between parent's age, race and ethnicity, education, and intention to quit smoking with having a strictly enforced smoke-free car policy. In the multivariable logistic regression model (Table 4), we confirmed that factors associated with greater likelihood of having a strictly enforced smoke-free car policy were having a child <1 year old versus ≥1 year (OR: 1.64 [95% CI: 1.14–2.34]) and parents smoking ≤10 cigarettes per day versus >10 cigarettes per day (OR: 3.59 [95% CI: 2.45–5.26]). Having another smoker in the home versus not having another smoker at home was associated with a lower likelihood of having a strictly enforced smoke-free car policy (OR: 0.56 [95% CI: 0.35–0.89]). The model fit was acceptable with a C statistic of 0.70.

In the exploratory analyses, we arrived at a final model after considering all possible interactions between the 4 parent demographic variables (age, gender, race, and education) and the 3 significant predictors of car policy (child's age, number of cigarettes smoked per day by the parent, and having another smoker at home). Parent gender and education interacted with child's age: parents of children aged <1 year were more likely to have strict smoke-free car policies if they were female (OR: 3.00 [95% CI: 1.22–7.38], *P* = .016) or college educated (OR: 2.42 [95% CI: 1.21–4.83], *P* = .013). Strict smoke-free car policies were more common when parents were both light smokers (smoked ≤10 cigarettes per day) and college educated (OR: 2.88 [95% CI: 1.24–6.66], *P* = .013). No other interactions were statistically significant. The model fit was acceptable with a C statistic of 0.71.

**TABLE 2** Parental Smoking Behavior in Cars and Pediatrician Assistance (*N* = 795)

Variable	<i>N</i> (%)
Parents' smoking behavior in their cars	
Someone smoked in their car in the past 3 mo	580 (73)
Have a smoke-free car policy	
Yes	233 (29)
No	562 (71)
Smoked with child present in the car	268 <sup>a</sup> (48)
Have a strictly enforced smoke-free car policy	187 (24)
Pediatrician assistance	
Asked about smoking status	169 (21)
Asked about smoke-free car	116 (14)
Advised about a smoke-free car	101 (12)
Type of visit	
Routine well-child visit	55 (54)
Sick visit	34 (34)
Other reason	12 (12)
Youngest child's age, y	
<1	36 (36)
1–4	40 (40)
5–9	15 (15)
≥10	10 (9)

<sup>a</sup> *N* = 562 (parents who allow smoking in their car).



**TABLE 3** Strictly Enforced Smoke-Free Car Policy by Parent and Child Characteristics (*N* = 795)

Characteristic	Have a Strictly Enforced Smoke-Free Car, <i>n</i> = 187 (24%)	Do Not Have a Strictly Enforced Smoke-Free Car, <i>n</i> = 608 (76%)	<i>P</i> Value
<b>Smoking-related characteristics</b>			
No. of cigarettes per day			
1–10	159 (31)	359 (69)	<.001
>10	28 (10)	249 (90)	
Quit readiness			
Consider quitting in 6 mo	133 (23)	441 (77)	.96
Seriously planning to quit in 30 d	90 (26)	254 (73)	.07
Strictly enforced smoke-free home policy			
Yes	153 (34)	298 (66)	<.001
No	34 (10)	310 (90)	
<b>Demographic characteristics</b>			
Age, y			
18–24	58 (31)	131 (69)	.03
25–44	119 (22)	434 (78)	
≥45	10 (19)	43 (81)	
Gender			
Male	40 (23)	137 (77)	.74
Female	147 (24)	471 (76)	
Race/ethnicity			
Hispanic (any race)	28 (27)	74 (73)	.64
White	122 (22)	426 (78)	
Black or African American	27 (25)	80 (75)	
Other	10 (26)	28 (74)	
Education			
<High school	17 (18)	79 (83)	.36
High school graduate	77 (23)	256 (77)	
Some college	56 (24)	179 (76)	
College graduate	36 (28)	93 (72)	
Other smokers in home			
Yes	91 (20)	373 (80)	.002
No	96 (29)	235 (71)	
Youngest child's age, y			
<1	66 (32)	141 (68)	<.001
1–4	84 (30)	202 (71)	
5–9	19 (12)	133 (88)	
≥10	16 (11)	125 (89)	
Child's insurance coverage			
Medicaid	106 (22)	367 (78)	.20
Private insurance/HMO	68 (27)	183 (73)	
Other/self-pay	13 (18)	58 (82)	

HMO, health maintenance organization.

## DISCUSSION

In this large sample of parents who smoked and visited a pediatrician, few parents reported having a strictly enforced smoke-free car policy, and approximately one-half of those without policies smoked in their cars with children present. Having a child aged <1 year and being a lighter smoker ( $\leq 10$  cigarettes per day) were associated with greater odds of having a strictly enforced smoke-free car policy. Having another smoker in the

home was associated with decreased odds of having a strictly enforced smoke-free car policy. Few parents who smoked were advised by a pediatric health care provider to have a smoke-free car.

Studies have shown that smoking 1 cigarette in a confined space such as inside a car creates unsafe levels of respiratory suspended particles.<sup>15</sup> Previous research conducted in Greek and German populations has shown that increased numbers of cigarettes

smoked per day by the parent<sup>39</sup> and lower parental education<sup>39,40</sup> were associated with increased TSE of children in cars. In our study, we found that parents who smoke more cigarettes per day had lower odds of having a strictly enforced smoke-free policy in their car. Although it is important to intervene with all parents regarding strict smoke-free car policies, it is possible that parents who smoke fewer cigarettes may have less difficulty abstaining when driving and could be more receptive to advice from a health care provider. In our exploratory analyses, we also found that college-educated parents of children aged <1 year were more likely to have strict smoke-free car policies. This finding challenges the assumption that more educated parents who smoke protect children of all ages from TSE and highlights the need to address having strict smoke-free car policies with all parents regardless of their education level.

Most parents who had a strictly enforced smoke-free car policy had a strictly enforced smoke-free home policy, and few parents who reported having a strictly enforced smoke-free car policy did not have a strictly enforced smoke-free home policy. However, 2 of 3 parents with strict smoke-free home policies did not have strict smoke-free car policies, suggesting that parents may not recognize TSE in cars as an important exposure source for their children. The association between having a younger child and car smoking policy may reflect parental belief that TSE is more harmful to younger children versus older children. These findings reinforce the importance of educating parents about the dangers of TSE to all children, irrespective of location and age.

To our knowledge, no study has looked at the rate at which pediatric health care providers ask about and advise

**TABLE 4** Multivariable Logistic Regression Showing Odds of Having a Strictly Enforced Smoke-Free Car Policy (N = 793)

Variable	OR (95% CI)
Youngest child's age	
<1 y	1.64 (1.14–2.34) **
≥1 y	1.0 <sup>a</sup>
No. of cigarettes per day	
Light smoker (≤10 cigarettes per day)	3.59 (2.45–5.26) ***
Heavy smoker (>10 cigarettes per day)	1.0 <sup>a</sup>
Other smoker in home	
Yes	0.56 (0.35–0.89)*
No	1.0 <sup>a</sup>

Adjusted for parent age, education, and race and gender, none of which was statistically significantly related to having a strictly enforced smoke-free car policy.

<sup>a</sup> Reference group.

\*  $P < .05$ ;

\*\*  $P < .01$ ;

\*\*\*  $P < .001$ .

parents to enforce smoke-free car policies. Bringing their children to the pediatric office for a visit may create a teachable moment for parental smoking cessation and for addressing TSE.<sup>31</sup> Most of the parents with whom smoking was addressed reported bringing their children in to the pediatric office for routine well-child visits. Although there may be more time available to discuss tobacco use at routine well-child visits, extending intervention to sick visits might enhance parental receptivity to advice, which might help to eliminate a risk factor (ie, TSE) for their child's disease. Although some pediatric offices have systems to prompt clinicians to screen for parental tobacco use, few systematically use the full range of evidence-based tobacco control techniques to reduce TSE of children and even fewer include reducing the intense TSE in cars. Childhood TSE in confined spaces should be considered an intervention priority in the pediatric setting because children's exposure to TSE is involuntary, and no one other than the child's health care provider may have the opportunity to advocate for smoke-free cars. Most health care plans pay for tobacco

counseling given to parents if >50% of the total visit time is spent on counseling parents about tobacco use.<sup>42</sup> The pediatrician may also be in the best position to advocate for the children's need to breathe clean air given that the parents expect to hear about health issues that affect their child in this context. Home TSE has been a more traditional focus of pediatric tobacco control counseling, but children may spend a considerable amount of time in their family's car. Action to protect children from TSE in cars could proceed on multiple levels which include developing and testing interventions that address parental smoking in the pediatric health care setting and developing public health campaigns at the population level to educate smokers about the dangers of TSE and emphasize the need for smoke-free cars for children. A recent study conducted in 4 countries showed that the majority of smokers supported a ban on smoking in cars with children, with 60% of US smokers supporting the ban.<sup>43</sup> Levels of support were higher in Australia (83%), the United Kingdom (75%), and Canada (74%). Pediatricians can advocate for smoke-free cars and help develop new legislative approaches to protect children from TSE in cars. Opportunities may also exist in adult medicine, obstetrics, and in hospitals to address TSE of children and other vulnerable individuals.<sup>44</sup>

Although the study surveys were administered in-person and directly after clinic visits, the results are based on parental self-report and thus are subject to recall and response bias. Results likely provide a lower-end estimate of true childhood TSE in cars. Also, the results are based on cross-sectional survey data, and we therefore cannot determine causality. Despite these limitations, the use of a large sample size across 8 states allows greater confidence in reporting that the prob-

lem of childhood TSE in cars exists in the United States. In future studies, biomarkers of TSE could be used to quantify degree of exposure in the subsample of children who have smoking bans at home and are exposed to tobacco smoke only in cars. To determine health outcomes of children exposed to tobacco smoke only in cars, longitudinal follow-up of children who were and were not exposed to tobacco smoke only in cars will be helpful.

## CONCLUSIONS

This research highlights the magnitude of the problem of parents exposing their children to tobacco smoke in cars. Strict 100% smoke-free car policies would help reduce TSE of children and aid in protecting them from its harmful health effects. Pediatricians can help protect children from TSE in cars by prioritizing addressing tobacco use with parents and advising them to have strict smoke-free car policies. US pediatricians can also advocate for their patients by presenting the case to lawmakers and/or lobbyists for introducing legislation that protects children from TSE in cars as has been done in some states and in the United Kingdom.<sup>23</sup> Finally, given the low rates of clinical intervention on this issue, pediatricians might concurrently consider supporting broader health promotion campaigns that address the dangers of parental smoking in cars.

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## Parents Smoking in Their Cars With Children Present

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