Review

Protecting children: Reducing their environmental tobacco smoke exposure

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The present review examines the current status of efforts to reduce environmental tobacco smoke exposure (ETS) among infants and young children. Estimates of the number of children exposed vary, but it is probably over 20 million or about 35% of all U.S. children. Healthy People 2010 sets as an objective the reduction, to 10%, of the proportion of children regularly exposed to tobacco smoke at home. Children with ETS exposure are at higher risk for upper respiratory illnesses, asthma, otitis media, and sudden infant death syndrome. Eight experimental or quasi-experimental studies of attempts to reduce children’s ETS exposure with sample sizes of greater than 100 were conducted in the United States and published between 1990 and 2003. Most of these studies showed a significant impact on maternal smoking and on the number of cigarettes smoked in the home, although intervention-control differences were relatively small. Despite support from professional organizations and federal government groups, many pediatricians and family physicians do not routinely engage in intensive efforts to reduce children’s ETS exposure. Training in techniques for reducing tobacco dependence should be included in professional education programs. Public and private insurance should reimburse providers for efforts in this area. An overall strategy for reducing children’s ETS exposure should combine individual counseling and education in offices, clinics, and homes with community education and regulatory and economic policies (i.e., smoking bans and excise taxes). Additional funding is needed for studies of provider knowledge, attitudes, and practices; of the effectiveness of various communication strategies; and of office- and community-based strategies to reduce ETS exposure.

Introduction

Attempts at controlling tobacco use by changing the behavior of populations appear to have followed a chronological order that reflects the priority given to these attempts. The government at various levels and nonprofit groups initially focused on the smoking habits of adults, probably due to research findings on the relationships between smoking and adult chronic illnesses. Later, the realization that it was probably easier to prevent smoking initiation among youth than to change the behavior of smoking adults led to campaigns to discourage adolescents from beginning to smoke. More recently, considerable attention has been paid to smoking by pregnant women because of its impact on birth weight and the health problems faced by low birthweight infants. The population that has received the least public and professional attention has been parents or others who smoke in households or cars in which infants and children spend considerable time.

This article reviews selected aspects of environmental tobacco smoke (ETS) exposure (passive smoking) as they affect infants and young children. (ETS or second-hand smoke is defined as the smoke inhaled by an individual not actively engaged in smoking but due to exposure to ambient tobacco smoke.) First, we provide estimates of the amount of exposure experienced by infants and young children and the potential consequences of such exposure. Then we describe interventions that may reduce passive smoking including counseling of parents, community education, and regulatory and economic policies. Finally, we suggest possible next steps in addressing this problem.
Estimates of children’s ETS exposure and its consequences

Children’s exposure to ETS can be measured by the report of an adult in the child’s household; by testing the child or a household member using a biomarker, such as the cotinine level in saliva, blood, or urine; or by using an environmental monitoring device. Most studies find a high correlation between self-report and biomarkers or environmental monitors. Nevertheless, biomarkers are usually considered to provide the most valid measure of ETS (Hovell, Zakarian, Wahlgren, Matt, & Emmons, 2000; Weaver, Buckley, Groopman, 1998). Children are exposed to ETS in many places, including stores, restaurants, and other public spaces, but the most concentrated exposure is probably in the home, from both residents and visitors, and in the vehicles of smoking parents, caregivers, or others.

Exposure

Most estimates of the exposure of infants and young children to tobacco smoke are based on adult report. For example, Schuster, Franke, and Pham (2002) used the 1994 National Health Interview Survey and Year 2000 Objectives supplement to examine adult reports of smoking in households with children. They found that 21 million children under age 18 (35% of all children) lived in households where the respondent reported that residents or visitors smoked in the home on a regular basis (at least one day or more per week). Regular smoking occurred in 36% of homes in which children resided. Moreover, in 92% of homes with children where residents smoked at home, they smoked every day of the week. Even children with nonsmoking parents had ETS exposure. Among nonsmoking respondents with children, 16% stated that other residents or visitors smoked in the home. In homes where no residents smoked, 6% reported regular smoking by visitors.

The Centers for Disease Control and Prevention (CDC, 1997) developed state-specific prevalence data on children’s ETS exposure using data from the 1996 Behavioral Risk Factor Surveillance System. The CDC reported that the percentage of households with an adult smoker and any children ranged from 7.0% to 14.9% (median = 9.8%). The percentage of those households in which smoking was allowed in some or all areas of the home ranged from 70.6% to 95.6% (median = 87.5%), and the percentage of children exposed to ETS in the home ranged from 11.7% to 34.2%.

Kahn, Certain, and Whitaker (2002) used data from the 1988 National Maternal and Infant Health Survey and the 1991 Longitudinal Follow-Up to examine postpartum smoking by mothers. A total of 29% of the women in the survey reported smoking during the 12 months before delivery, 56% of these women quit smoking for at least 1 week during pregnancy, and 72% of women who quit were smoking again at 17 months postpartum. Adding those who never stopped smoking, those who relapsed, and those who initiated smoking postpartum, 26% of the original sample of pregnant women were smoking at 35 months postpartum.

Because the Third National Health and Nutrition Examination Survey (NHANES III), conducted from 1988 to 1994, drew subjects’ blood and tested it for serum cotinine, Mannino, Caraballo, Benowitz, and Repace (2001) were able to determine ETS exposure using a biomarker in addition to parental reporting. Only children aged 4–16 years were studied, and children who admitted smoking or whose cotinine levels indicated current use of cigarettes or spit tobacco were omitted from the analysis. Almost 40% of the 5,653 eligible children came from homes in which an adult reported smoke exposure (smoke-exposed group). The mean cotinine level among children in the smoke-exposed group was 1.665 ng/ml; in the non-smoke-exposed group, it was 0.31 ng/ml. The youngest children (aged 4–6) had the highest mean cotinine levels in the smoke-exposed group, and the oldest children (aged 12–16) had the highest levels in the non-smoke-exposed group. Among children in the smoke-exposed group, the average number of cigarettes smoked daily in the home was the best predictor of cotinine level, suggesting the validity of adult report. The authors noted that although parents might be able to reduce some sources of exposure by modifying the smoking behavior of household members, children in nonsmoking households were still exposed. Further, they noted that reducing this exposure would require community-level interventions, such as limiting smoking in public spaces.

Gergen, Fowler, Maurer, Davis, and Overpeck (1998) focused on children aged 2 months through 5 years in their analysis of NHANES III. They found that 23.9% of children in this age range lived in homes where 1 to 19 cigarettes were smoked a day and 14.5% lived in homes where 20 or more were smoked. Non-Hispanic White children were exposed to the highest levels of ETS, and Mexican-American children were exposed to the lowest levels.

Consequences

ETS exposure has been linked to several health conditions in children and to increased need for medical care. Children with ETS exposure have more lower respiratory infections, otitis media, chronic bronchitis, wheezing, and asthma and are more likely to die of sudden infant death syndrome. They make more medical visits, are hospitalized more frequently, and lose more days from school (American Academy of Pediatrics [AAP], 1997; Anderson & Cook, 1997; California Environmental Protection...
Moreover, the children of smokers are more likely to smoke as adolescents and adults (CDC, 2002). A recent article found an association between ETS and pediatric dental caries (Aligne, Moss, Auninger, & Weitzman, 2003). The long-range impact on developmental outcomes is still controversial, particularly because it is difficult to separate the consequences of maternal smoking during pregnancy from those of ETS exposure after birth.

NHANES III has provided population-based data on the consequences of ETS exposure for children. Gergen et al. (1998) found that such exposure increased chronic bronchitis and three or more episodes of wheezing among children aged 2 months to 2 years and asthma among children aged 2 months to 5 years. ETS exposure had little effect on the respiratory health of children aged 3 to 5 years, with the exception of those with asthma. ETS appeared to increase the prevalence rather than the severity of asthma, as measured by medication use.

Also using NHANES III, Lieu and Feinstein (2002) examined the effect of both gestational and passive smoke exposure on ear infections in children under age 12 years. They found that passive smoke exposure was not associated with increased risk of ever having an ear infection and that combined exposure to maternal smoking during pregnancy and ETS had marginal clinical significance. However, combined exposure had a clinically and statistically significant effect on recurrent ear infections.

Reducing passive smoking through counseling

Although smoking behavior and ETS exposure may be influenced more by regulatory and economic policies, the present review focuses primarily on counseling and educational efforts implemented in clinical facilities and in homes. It also describes the findings of studies of physician practices in relation to counseling and the support that clinicians receive from their professional organizations in this area.

Clearly, discouraging adolescents and adults from initiating smoking would have the largest positive effect on reducing young children’s ETS exposure. Failing that, efforts to have women stop smoking before or during their pregnancies would have a large potential impact, and, in fact, considerable effort is now being expended to convince pregnant women who smoke to quit during their pregnancies (National Partnership to Help Pregnant Smokers Quit, 2002). The present review, however, focuses on three other behavior-modification approaches: (a) reducing post-partum relapse among mothers who stopped smoking during pregnancy (for further information about relapse prevention programs and their successes, see the article by Dolan-Mullen in this issue), (b) achieving smoking cessation among mothers who did not quit during pregnancy and among other household members who smoke, and (c) modifying the smoking habits of household members and guests by prohibiting smoking in certain rooms, in the home entirely, and in cars. The second approach is probably the most difficult to achieve. In regard to household smoking, ongoing research unfortunately suggests that the households of smokers are extensively contaminated with nicotine—in dust, on surfaces, and on the skin and clothing of parents. Thus, changing where smoking takes place, but not completely eliminating it, may have a limited effect on exposure (M. F. Hovell, personal communication).

Interventions with caregivers

Relatively few studies of counseling efforts to reduce children’ ETS exposure were published prior to the 1990s, but the past ten years have seen an increase in randomized trials of such interventions. However, these studies have not been subject to a meta-analysis similar to the one conducted by Dolan-Mullen, Ramirez, and Groff (1994) or to a meta-evaluation similar to the one conducted by Windsor, Boyd, and Orleans (1998) for smoking cessation during pregnancy. The present review is limited to studies with over 100 subjects at follow-up (or over 100 subjects at baseline and analyses based on intention-to-treat)—where at least part of the intervention was conducted after delivery. Further, these studies used experimental or quasi-experimental designs, were conducted in the United States, and were published in an American or British journal.

Behavioral interventions have been classified as minimal, low intensity, and high intensity (Valanis et al., 2001). The present discussion is divided into two types of studies: (a) relatively weak interventions (minimal and low intensity), usually including a brief interaction between provider and caregiver in a clinic setting supplemented by educational materials and sometimes brief reinforcement contacts, and (b) stronger interventions (high intensity), usually including extended counseling in an office or a home by individuals (often nurses) trained in smoking cessation techniques, supplemented by educational materials and often with support from a primary care provider. (Within each category the studies are arranged chronologically by date of publication.) Although many studies report findings favoring the intervention group, only results significant at the .05 level or with confidence intervals that do not include 1 are reported. The studies are summarized in Tables 1 and 2.
### Table 1. Studies with relatively weak interventions.

<table>
<thead>
<tr>
<th>Study</th>
<th>Research design and sample size at follow-up (or baseline if follow-up number not given)</th>
<th>Subjects</th>
<th>Intervention</th>
<th>Selected outcome variables</th>
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<tbody>
<tr>
<td>Wall et al. 1995</td>
<td>Randomized trial (practices randomized)</td>
<td>Mothers of infants: current smokers or had quit during pregnancy; Oregon</td>
<td>Brief counseling by pediatrician trained in smoking intervention at 2-week and 2-, 4-, and 6-month well-baby visits</td>
<td>At 6 months:</td>
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<td></td>
<td>Maternal sample: Intervention (I) = 1,356 Control (C) = 980</td>
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<td></td>
<td>• Quit rates among smokers: I = 5.9%; C = 2.7% (significant)</td>
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<td></td>
<td>• Nonrelapse rates among quitters at enrollment: I = 55%; C = 45% (significant)</td>
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<td></td>
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<td>• Among smokers: more ETS knowledge and better attitudes; more likely to prohibit smoking in the home (significant)</td>
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<tr>
<td>Severson et al. 1997</td>
<td>Same as above at 12 months Intervention and control = 2003</td>
<td>Same as above</td>
<td>Same as above</td>
<td>At 12 months:</td>
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<td></td>
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<td></td>
<td></td>
<td>• Higher continuous quit rates for smokers, I = 2.3%; C = 1.2% (significant), and quitters at enrollment, I = 32.8%; C = 26.1% (significant)</td>
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<td></td>
<td></td>
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<td>• Logistic regression found no effect of intervention on sustained quitting for either group</td>
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<tr>
<td>Van't Hof et al. 2000</td>
<td>Randomized trial</td>
<td>Mothers of infants: quit smoking during pregnancy; Portland, Oregon</td>
<td>15- to 30-minute relapse prevention counseling from Visiting Nurse Association nurse; reinforcement from pediatric provider at 2-week, 2-month, and 4-month well-baby visits</td>
<td>At 6 months:</td>
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<tr>
<td></td>
<td>Intervention = 133 Control = 144</td>
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<td></td>
<td>• Relapse rate: I = 42%; C = 37% (NS)</td>
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<tr>
<td>Valanis et al. 2001</td>
<td>Prospective quasi-experimental</td>
<td>Mothers of infants: smokers during pregnancy or quit before conception; Portland, Oregon (Kaiser-Permanente)</td>
<td>Brief motivational interviewing by trained nursing staff at all prenatal visits and well-baby visits</td>
<td>At 12 months:</td>
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<td></td>
<td>Intervention = about 700 Historical comparison (HC) = about 1,000</td>
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<td></td>
<td>• No smoking in last 6 months: I = 18.4%, HC = 14.9% (significant)</td>
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<td></td>
<td></td>
<td>• Took action to protect infant from ETS: I = 88.0%, HC = 73.4% (significant)</td>
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<td></td>
<td>• Logistic regression for sustained quit rate (OR = 2.7; significant); for smoking abstinence between 6 and 12 months (OR = 2.4; significant)</td>
</tr>
</tbody>
</table>
### Table 2. Studies with stronger interventions.

<table>
<thead>
<tr>
<th>Study</th>
<th>Research design and sample size at follow-up (or baseline if follow-up number not given)</th>
<th>Subjects</th>
<th>Intervention</th>
<th>Selected outcome variables</th>
</tr>
</thead>
</table>
| Greenberg et al. 1994 | Randomized trial  
Intervention (I) = 329  
Control (C) = 330 | Smoking and nonsmoking mothers of infants; two North Carolina counties | Four 45-minute visits by study nurse during first 6 months | At 12 months:  
- Change in cigarettes/day exposure among infants of smoking mothers:  
  I = 1.25–7.7, C = 12.3–13.3 (significant)  
- Prevalence of persistent lower respiratory symptoms among infants of smoking mothers:  
  I = 17.8, C = 30.9% (significant)  
- Differences in infant serum cotinine levels or acute lower respiratory illness (NS) |
| Hovell et al. 2000  | Randomized trial  
Intervention = 52  
Control = 42 | Smoking mothers of children aged < 4 years recruited from WIC offices; San Diego County, California | Three in-person individualized counseling sessions in the home and four sessions by phone | At 12 months (intention-to-treat analyses):  
- Cigarettes/week exposure: I = 8.6, C = 19.2 (significant)  
- Infant urine cotinine level: I = 10.5 ng/ml, C = 17.5 ng/ml (significant) |
| Emmons et al. 2001 | Randomized trial  
Intervention = 124  
Control = 123 | Mothers or grandmothers: current smokers or quit within 3 months; child in household aged < 3 years | 30- to 45-minute motivational interviewing in home with trained health educator and four phone calls; feedback from baseline household air nicotine assessment and assessment of participant's carbon monoxide level | At 6 months:  
- Nicotine level measured by sampling monitors in kitchen: I = 2.6 mg/m³, C = 6.9 mg/m³ (significant)  
- In television room: I = 2.3 mg/m³, C = 3.5 mg/m³ (significant) |
| Hovell et al. 2002 | Randomized trial  
Coached + education = 97  
Education only = 96 | Latino families with asthmatic child aged 3–17 years; living in household with at least one smoker and exposure to at least six cigarettes in previous week; San Diego County, California | Asthma management education in one or two household sessions (1.5 hours) by trained Latina assistants for both groups; coaching through seven in-home 30- to 45-minute sessions over 3 months and booster phone calls | Over 13 months (intention-to-treat analyses):  
- Change in cigarettes/day exposure: coached = 2.25–0.47, education only = 2.12–0.71 (significant)  
- Decrease in children's cotinine level: coached = 1.44–0.97 ng/ml, education only = 1.17–0.86 ng/ml (significant) |
| Curry et al. 2003 | Randomized trial  
Intervention = 156  
Control = 147 | Smoking women accompanying children to pediatric care visits; Seattle, Washington | Brief motivational message from clinician; self-help guide; 10-minute motivational interview with nurse or study interventionist and up to three counseling phone calls with same person in next 3 months | At 12 months (intention-to-treat analyses):  
- Serious attempt to quit: I = 61%, C = 51%; adjusted OR = 1.53 (NS)  
- Ever quit for 24 hours: I = 57%, C = 60%; adjusted OR = 0.94 (NS)  
- Prevalent abstinence: I = 13.5%, C = 6.9%; adjusted OR = 2.77 (significant) |

**Note:** WIC = Special Supplemental Nutrition Program for Women, Infants, and Children program.
Studies with relatively weak interventions. Wall, Severson, Andrews, Lichtenstein, and Zoref (1995) enrolled mothers of newborns from 49 private pediatric practices into a Modification of Maternal Smoking (MOMS) project. The practices were randomized into an extended and a minimal intervention. Those in the extended intervention received oral and written advice at usual well-baby visits at 2 weeks and 2, 4, and 6 months, plus a hospital packet containing written information about passive smoking and a letter advising them to quit. The control (minimal intervention) group received the hospital packet only. Those in the extended intervention had significantly higher quit rates and lower relapse rates at 6 months postpartum. Even among mothers still smoking, those in the extended intervention allowed less smoking in the home. At 12 months postpartum, the impact on quit rates was reduced but still present, but a logistic regression found no significant treatment effect (Severson, Andrews, Lichenstein, Wall, & Akers, 1997).

Van’t Hof, Wall, Dowler, and Stark (2000) combined a 15- to 30-minute relapse prevention intervention by a nurse from a Visiting Nurse Association with reinforcement from the pediatric provider at the 2-week and 2- and 4-month well-baby visits. Although the women in the intervention group were more likely than controls to report that a physician or nurse talked to them about smoking or that they received written materials about staying quit, there was no effect on relapse prevention or on the number of cigarettes smoked per day.

Valanis et al. (2001) evaluated the Stop Smoking for OuR Kids (STORK) program in a group-model health maintenance organization (HMO). Clinic staff and providers used motivational interviewing during prenatal and well-baby visits. At 12 months postpartum, a significantly higher percentage of women in the intervention group reported not smoking in the past 6 months and taking action to protect the infant by smoking outside of the home and requiring others to do so.

Studies with stronger interventions. Greenberg et al. (1994) conducted a randomized trial with four nurse home visits during the first 6 months of life. Although the intervention group infants were exposed to significantly fewer cigarettes per day at the 12-month follow-up, no difference was found in infant urinary cotinine levels. Among smoking mothers whose head of household had no education beyond high school, the prevalence of persistent lower respiratory symptoms was lower in the intervention group.

Hovell, Zakarian, Matt, and colleagues (2000) recruited smoking mothers from a Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program and randomized them into an intervention group that received seven individualized counseling sessions: three in-person at home and four by phone. The counseling was based on shaping procedures and conducted by master’s level students in psychology, public health, or other relevant disciplines. At 12 months, mothers’ reports of children’s exposure to their smoke had declined significantly in the intervention group, as had reported exposure to smoke from all sources. Mean cotinine levels decreased slightly in the experimental group but increased in the control group.

Emmons et al. (2001) recruited from primary care settings low-income families with children under age 3 years for a randomized trial of a motivational intervention, Project KISS (Keeping Infants Safe from Smoke). The intervention consisted of a 30- to 45-minute motivational interviewing session by a trained counselor in the subject’s home and four follow-up telephone counseling calls. Also provided was feedback from a baseline household air nicotine assessment and from an assessment of the subject’s carbon monoxide level. The comparison group received smoking educational materials only. Although the difference in quit rates between the two groups was not significant at the 6-month follow-up, the nicotine levels in the kitchen and in the television room decreased significantly over time in the experimental group whereas nicotine levels increased in the control group.

Hovell et al. (2002) attempted to reduce ETS exposure among asthmatic Latino children. This was particularly challenging because the rate of smoking among Mexican immigrants is relatively low and the majority of mothers in the study were nonsmokers. Thus, the mothers needed to limit the ETS exposure from fathers and other family members. Both experimental and control groups received asthma management education. The experimental group also received “coaching” through seven in-home 30- to 45-minute sessions over 3 months plus a booster phone call. Coaching included contingency contracting and shaping procedures. The counselors were undergraduate students and women from the Latino community who were trained and supervised by the researchers. In the month after coaching ended, parents in the experimental group reported that their children were exposed to significantly fewer cigarettes, compared with the control group. Mean cotinine levels decreased in the experimental group and increased among controls. By 13 months post-baseline, however, little difference existed between the two groups in exposure prevalence or in cotinine levels.

Curry et al. (2003) offered smoking women attending hospital and HMO clinics a program that combined a motivational message from the child’s clinician, who had received training in this technique; a 10-minute motivational interview with a nurse or
study interventionist; up to three outreach telephone counseling calls from the same person in the 3 months following the visit; and a self-help manual. The outcome variables at the 12-month follow-up were as follows: serious attempt to quit; ever quit for 24 hours; 7-day prevalent abstinence; and sustained abstinence, defined as being abstinent at both the 3- and the 12-month follow-ups. The odds ratio for prevalent abstinence at 12 months was significantly higher in the intervention group in both the adjusted intention-to-treat analyses and complete cases analyses. The serious attempt to quit variable was significant only in the complete case analyses.

Summary. The studies reviewed here suggest that office- and home-based interventions to protect children from ETS exposure can be effective, even if they are of relatively low intensity. However, researchers should be urged to provide details about the amount of counseling or education received by subjects. Often this amount is less than specified in the protocol, and this failure to implement the program completely may be one reason for the absence of significant effects or for relatively small differences. The review also shows two approaches to the measurement of outcomes: (a) by determining whether the mother has quit smoking or not relapsed to her prepregnancy smoking status and (b) by monitoring the amount of smoke in the home by self-report of cigarettes smoked, air monitoring, or infant cotinine level. Based on a comparison between intervention and control groups in the six studies that conducted a follow-up 12 or more months after the intervention began, two of the three that measured maternal smoking showed a significant impact on maternal smoking (although in one study, regression analysis did not confirm the effect) and the third had mixed results. All three that studied the number of cigarettes smoked in the home reported significant impacts. Two of the three that measured infant cotinine level at 12 months showed a significant difference between the intervention and control groups. However, some of the intervention-control differences were relatively small, even if statistically significant. Berman (2003), in an editorial commenting on the Curry et al. (2003) article, questioned whether the amount of change justified the expenditure of time that the pediatrician and other staff needed to conduct this program.

Physician practices

Several studies suggest that many pediatricians and other clinicians in private and public settings who are not involved in studies such as the ones just described do not routinely engage in intensive efforts to reduce children’s ETS exposure. Tanski, Klein, Winickoff, Auinger, and Weitzman (2003) combined data from the National Ambulatory Medical Care Survey and the outpatient portion of the National Hospital Ambulatory Medical Care Survey for 1997 to 1999 to determine the frequency of counseling about children’s ETS exposure. Only 1.5% of all 33,823 ambulatory care visits by children included tobacco counseling. Well-child visits included counseling 4.1% of the time; illness visits for asthma, 4.4%; and illness visits for otitis media, 0.3%.

The low rate of counseling has been attributed to lack of training in tobacco counseling, a belief that such activity is not the clinician’s responsibility, uncertainty about one’s ability to assist smoking parents, weak professional support, and inadequate or nonexistent reimbursement for counseling. In 1995–1996, Zapka et al. (1999) surveyed a sample of 350 Massachusetts pediatricians (response rate = 75%) and their intervention practices related to tobacco use and cessation. On a performance scale of 0 to 10, pediatricians received a mean rating of 0.77 for encouraging children and adolescents not to smoke, 4.73 for intervening with children and adolescents who already smoke, and 3.23 for counseling parents who smoke. Pediatricians who had received training in counseling about tobacco issues reported significantly higher levels of counseling of smoking parents (mean score of 5.28 for those with training and 3.03 for those without). Predictors of pediatricians’ counseling of parents included (a) the belief that such counseling was a “great” part of their role and that smoking cessation counseling by pediatricians could be effective and (b) confidence in one’s ability to change parents’ smoking behavior.

A study of a random sample of 1,000 members of the AAP and all 724 members of the AAP sections on pulmonology, otolaryngology, and allergy (response rate = 44%) reached similar conclusions (Burnett & Young, 1999). Forty-one percent of general pediatricians always asked about passive smoke exposure during well-child visits, 87% asked during visits related to asthma, and 56% asked during visits related to recurrent otitis media. Eighty-five percent of general pediatricians offered only nonspecific advice such as “Don’t smoke around the child.” Reasons for not doing more included lack of skills (38%) or time (36%), or a belief that it was not the physician’s responsibility (13%).

In 1997–1998, Perez-Stable et al. (2001) conducted a study of a random sample of 899 pediatricians and family physicians (response rate = 56%) in urban California. Sixty-two percent of pediatricians and 65% of family physicians asked parents of children under age 6 years whether they smoked regularly, but 79% of pediatricians, as compared with 69% of family physicians, discussed the child’s health risk from second-hand smoke. Only 56% of pediatricians and 61% of family physicians tried to motivate parents to
quit smoking. Regression analysis revealed that pediatricians were significantly less likely than family physicians to report use, at least half of the time, of 5 of the 14 practices that the authors believed would promote smoking cessation. The barrier to delivery of smoking cessation services chosen most frequently by pediatricians was “parents lack interest in quitting smoking” (45%), followed by “parents would ignore the advice” (39%). Family physicians were more likely to pick “it would be time-consuming” (41%) and “parents lack interest in quitting smoking” (27%). Physicians in private practice setting, compared with those in all other settings, were less likely to refer parents to smoking cessation programs ($OR=0.53$) or to ask nursing staff to counsel on cessation ($OR=0.48$).

Parental reports of counseling provide an equally bleak picture. In a 2001 telephone survey of U.S. households (almost 4,000 eligible respondents were contacted, 84% completed surveys, and 900 were parents with children living at home), about half of all parents who had visited a pediatrician or family physician reported being asked about smoking by household members. Pediatricians were more likely than family practitioners to ask all parents (38% vs. 29%) about rules prohibiting smoking in the home (49% vs. 33%) and in the family vehicle (28% vs. 14%). Fewer than half of parental smokers reported being counseled about dangers of second-hand smoke, being told about risks of modeling smoking behavior for children, or receiving advice to quit (Winickoff, McMillen, Klein, & Weitzman, 2002).

**Institutional support**

Professional groups encourage their members who care for pregnant women, mothers, and children to act aggressively to reduce children’s ETS exposure. The AAP has issued several policy statements on the role of pediatricians in reducing smoking. The most recent statement, “Tobacco’s toll: Implications for the pediatrician” (AAP, 2001) has several sections on ETS exposure. It cites the Public Health Service clinical practice guideline (Fiore et al., 2000) and suggests using six A’s to help address tobacco use (anticipate, ask, advise, assess, assist, and arrange follow-up). In addition, it states, “The pediatrician should assess tobacco use and ETS exposure in the extended family and environment, encourage smokers to smoke outside the house and to consider quitting, and provide relapse prevention for women who quit during pregnancy (50%-90% chance of relapse) and for other family members who have quit.” It also discusses nicotine replacement therapies, though more in the context of adolescent than caregiver smoking. (For information about the activities of the American College of Obstetricians and Gynecologists in this area, see the article by Chapin and Root in this issue.)

The public health community has indicated strong concern about children’s ETS exposure. For example, *Healthy People 2010* (U.S. Department of Health and Human Services [USDHHS], 2000a), a major policy publication of the federal Department of Health and Human Services, lists among its objectives, “Reduce the proportion of children who are regularly exposed to tobacco smoke at home.” The target is 10%, and the baseline is 1994 data from the National Health Interview Survey indicating that 27% of children younger than age 7 lived in a household where someone smoked inside the home at least 4 days per week. The report indicated that progress had been made toward this objective since *Healthy People 2000* was issued, when the objective was 20%.

Another federal agency, the Public Health Service, has issued a clinical practice guideline for treating tobacco use and dependence (Fiore et al., 2000). Included in its recommendations for special populations is, “Clinicians in a pediatric setting should offer smoking cessation advice and interventions to parents to limit children’s exposure to second-hand smoke.” The scientific evidence for this recommendation is rated as $B$, meaning that some evidence from randomized clinical trials supports the recommendation but that scientific support is not optimal.

In 2002, the American Public Health Association (2002) issued a policy statement, “Promoting evidence-based smoking cessation interventions for women before, during, and after pregnancy.” Although much of the statement focused on women and their health, some attention was paid to ETS exposure among children.

Other public health groups also have placed children’s ETS exposure on their list of smoking-related priorities. The Association of State and Territorial Health Officials, the National Association of County and City Health Officials, and the National Association of Local Boards of Health jointly issued a “Policy statement on tobacco use, prevention, and control” (undated). Among the 14 actions supported were “eliminate exposure to second-hand tobacco smoke, particularly in places where children would be exposed, in workplaces and indoor public areas, and in all government facilities and vehicles.”

In December 1997, the Association of Maternal and Child Health Programs, an organization of state maternal and child health (MCH) agencies, issued the report “Vital links: The MCH role in tobacco control.” Among the three top tobacco control priorities established by two focus groups of local and state MCH or tobacco control directors was “preventing exposure of pregnant women and children to environmental tobacco smoke in homes.” Despite this encouragement, the state performance measures, submitted subsequently by state MCH departments to the federal Maternal and Child Health Bureau, make no mention of ETS. Fifteen states had a measure
related to smoking, but almost all dealt with smoking by adolescents and pregnant women. None mentioned a goal of reducing ETS and only one mentioned smoking women generally.

**Community education**

Community education to reduce ETS has been undertaken by offering printed materials to smokers or those who influence them, and through mass media, billboards, and other broad-spectrum communications.

**Warning labels**

The educational messages about the dangers of smoking that get into the hands (though not necessarily the minds) of the largest percentage of smokers are the warning labels on cigarette packages. Certainly not all smokers read these messages, but their presence indicates societal concern about the consequences of smoking, and their source—the U.S. Surgeon General—makes them authoritative. Congress has required warning labels since 1965 and in 1981 specified four health messages on all cigarette packages and advertisements. None of these warnings mentions the effect of smoking on infants or children, although one mentions pregnancy complications among other conditions and another is devoted to possible pregnancy-related outcomes (fetal injury, premature birth, and low birth weight). The Surgeon General’s report “Reducing tobacco use” (USDHHS, 2000b) states that the “Warning labels that appear on cigarette packages in the United States are weaker and less prominent than those of many other countries.” It mentions that in Australia, six rotating messages cover a quarter of the front of the package. One side panel is devoted entirely to labeling of dangerous ingredients, and a third of the back panel includes an elaboration of the message. The Canadian government will soon require information about smoking-related diseases and quit methods on half of the front and back panels and labeling of dangerous ingredients on one side panel.

**State educational campaigns**

Several states have undertaken antismoking educational campaigns, often using tobacco settlement funds. The advertising campaigns in California, Massachusetts, and Michigan have been evaluated. Eight advertising strategies were identified: industry manipulation, second-hand smoke, addiction, cessation, youth access, short-term effects, long-term effects, and romantic rejection. The industry manipulation and second-hand smoke strategies were the most effective. Goldman and Glantz (1998) noted that “Secondhand smoke advertising seeks to convince smokers that their smoking endangers others; to help denormalize smoking by portraying the dangerous effects of secondhand smoke on nonsmokers; and to motivate smokers to quit.” Glantz (1993) found that in California the sale of cigarettes dropped at a greater rate after the media campaign was implemented than would have been expected on the basis of historical trends. Despite the evidence of the positive impact of these large-scale advertising campaigns, few billboard or other mass media focus on children’s ETS exposure. One exception is a poster developed by an advertising group for Tobacco Free Hall County, a local tobacco control coalition in Grand Island/Hall County, Nebraska. The poster shows a smoking cigarette inserted into a pacifier and carries the message “Secondhand smoke makes everyone smoke.” The coalition reports many requests for this poster (www.tobaccofreehallcounty.org).

**Educational materials**

The U.S. Environmental Protection Agency (EPA) has developed a campaign to reduce children’s ETS exposure. It includes a brochure entitled “Take the smoke-free home pledge.” The EPA gives instructions about how to keep a smoke-free home:

- Choose not to smoke in your home and do not permit others to do so.
- Choose not to smoke if children are present, especially infants and toddlers. They are especially vulnerable to the effects of secondhand smoke.
- Do not allow baby-sitters or others who work in your home to smoke in the house or near young children.
- If you must smoke, choose to smoke outside. Moving to another room or opening a window is not enough to protect your children.

Individuals may request the brochure from the EPA by phone (1-866-SMOKE-FREE), fax, e-mail, or online (www.epa.gov). Moreover, they can take a pledge online or by phone to make their home smoke-free and receive a Smoke-Free Home Kit as well as a certificate saying that the individual has made her or his home smoke-free.

The Fox Chase Cancer Center has produced an excellent magazine for mothers who smoke. It is being used by several state and local health departments under the title “Make yours a fresh start family” or “Quitting times.” It is targeted specifically at smoking mothers and its 45 pages are filled with hints about how to stop smoking. Other organizations, such as the American Cancer Society, the American Lung Association, and the AAP, also have produced material on passive smoking. These materials can be requested, made available in locations where smokers might pick them up, or distributed by clinicians.
A section of the CDC’s web site (www.cdc.gov) is devoted to the Tobacco Information and Prevention Source (TIPS), including several pages on second-hand smoke. The TIPS section provides minimal information on the extent and impact of ETS exposure on children. An online Toolkit is available to assist with helping reduce smoking in public places, and toolkits related to restaurants and bars, workplaces, and schools are promised. No mention is made of a toolkit related to exposure in the home.

Consumer knowledge

A national household survey suggests that the various attempts at public educations have had some impact, although not enough. In the 2001 telephone survey described earlier, Winickoff, McMillen, and Weitzman (2002) examined the level of consumer knowledge of the dangers of children’s ETS exposure. Although most respondents claimed that they banned smoking when children were present (88%) and most recognized the dangers of ETS exposure (95%), only 52% of smoking parents reported that it was not acceptable for parents to smoke in front of children and only 39% prohibited smoking in the home. The percentages for nonsmoking parents were 88% and 89%. In another report from the same survey, it was noted that 77% of respondents recognized the dangers of exposure to ETS in cars (McMillen, Winickoff, Klein, & Weitzman, 2002).

Regulatory and economic policies

Federal, state, and local policies are causing reductions in children’s ETS exposure. These policies are reflected in laws, regulations, and administrative agency actions. The CDC (1999) reported that as of the end of 1998, 46 states and the District of Columbia restricted smoking to some extent. The laws of greatest importance to children restricted smoking in child day care centers (28 states and the District), hospitals (42 states and the District), restaurants (30 states and the District), selected forms of public transportation (40 states and the District), grocery stores (29 states and the District), and enclosed arenas (23 states).

The public policies generally considered to have the most impact on smoking, and thus on ETS, are those setting cigarette excise taxes. Laws restricting the advertising and promotion of tobacco products also reduce smoking.

Next steps

General agreement appears to exist on a framework for reducing children’s ETS exposure. Most of the excellent reviews, commentaries, and editorials on the subject in the professional literature indicate that a multifaceted approach is necessary. Such an approach would (a) encourage efforts to modify smoking behavior of parents and others who interact frequently with children through counseling in clinical settings and homes and (b) promote massive public education campaigns. These efforts would be combined with tobacco control measures not addressed specifically at children’s ETS exposure, such as tax policies and laws regulating smoking in places where children are likely to be found.

The report “Recommendations regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke,” issued by the CDC’s Task Force on Community Preventive Services (2001), evaluated the components of this approach, based on reviews of evidence of effectiveness. Only the recommendations related to children’s ETS exposure are listed below, and the strength of the recommendation also is noted:

- Smoking bans and restrictions: strongly recommended
- Increasing the unit price for tobacco products: strongly recommended
- Campaigns (mass media education): strongly recommended when combined with other interventions
- Provider reminders: recommended
- Provider reminder plus provider education, with or without patient education: strongly recommended
- Reducing patient out-of-pocket costs for effective cessation therapies: recommended
- Multicomponent patient telephone support: strongly recommended

Among the interventions about which insufficient evidence was available to make a recommendation were community education and provider education and feedback. (As noted earlier, the Public Health Service’s guideline supports, at the B level, clinicians in pediatric settings offering smoking cessation advice and interventions to parents to limit children’s exposure to second-hand smoke. The Public Health Service panel evaluates clinical practices, whereas the CDC’s Task Force evaluates community preventive services.)

Modifying the behavior of children’s caregivers and their clinicians

Modifying the behavior of smokers is difficult, but, as many studies of parents and other adults have shown, it is not impossible. The Action Plan of the National Partnership to Help Pregnant Smokers Quit (2002) notes that pregnancy provides a “window of opportunity” for convincing women to stop smoking because of their concerns about fetal well-being. Presumably this concern does not stop when the child is born. Granted, the immediate postpartum
period is one of considerable stress, but it also is the period when mother and infant bond. The mother’s desire to have a healthy and happy child can be used to motivate her not to resume smoking, to consider stopping or reducing the number of cigarettes she smokes, or to smoke only in areas where the infant is not exposed.

Families with a child who has a health problem may be easier to convince of the need to modify their behavior. Some infants spend the first few days, weeks, or months of their lives in neonatal intensive care units, often for respiratory problems associated with prematurity. Parents of such infants should welcome advice about how to prevent additional hospitalizations or other problems. In fact, one research project supported by the Robert Wood Johnson Foundation’s Smoke-Free Families project is studying such a program (B. Becker, personal communication). Parents of children with recurrent otitis media, frequent lower respiratory infections, bronchitis, or asthma should be responsive to advice that might prevent a child’s suffering as well as preventing numerous trips to physicians’ offices and emergency rooms. A recent study focused on smoking among parents of hospitalized children and concluded that a child’s hospitalization provided a unique opportunity to enroll parents in cessation programs (Winickoff, Hibberd, Case, Sinha, & Rigotti, 2001). Parents who have lost an infant to sudden infant death syndrome should be made aware that smoking appears to contribute to such deaths and that smoking cessation might prevent another such tragedy.

Clinical counseling would probably occur more often and be more effective if providers were educated about techniques for encouraging changes in smoking-related habits and if insurance programs reimbursed providers for tobacco dependence-related services. Additional institutional support for effective counseling also might encourage such activities. In addition, specialized smoking cessation programs are needed so that providers can refer patients whose counseling needs are greater than what can be offered in general practices or homes.

Training. Training can improve physician behavior. Between 1996 and 1999, Hymowitz, Schwab, and Eckholdt (2001) used a quasi-experimental design to test the impact, on resident and patient behavior, of a comprehensive pediatric residency training program addressing tobacco. The program consisted of four 1-hour training sessions, each on a different topic once every 2 months on an annual basis. Additional supervision sessions were held after the second, third, and fourth sessions. The proportion of pediatric residents who reported trying to help patients or parents stop smoking increased significantly from 33% at the baseline survey (n = 27) to 79% in the year 4 survey (n = 28). These changes were not seen in medical and psychiatric residents who answered the surveys but did not participate in the training program. The proportion of pediatric residents who reported that they informed patients or parents about the hazards of ETS, advised parents to create a smoke-free household, advised parents not to expose young children to ETS, and helped parents to modify ETS in their homes increased significantly from year 2 (when these questions were first asked) to year 4. Parental reports of resident interventions were generally lower than residents’ reports, but they also showed an increase in assistance related to ETS between baseline and year 4. Moreover, the proportion of parents or guardians who reported creating a smoke-free household and asking visitors to smoke outside the house increased significantly.

Training in smoking cessation and reduction methods should be part of residency training and nursing education. The many physicians who admit feelings of inadequacy in this area indicate that such training is essential. Education about methods of modifying adult behavior is particularly important for pediatricians and those nurses who usually deal almost exclusively with children’s problems. These professionals have less experience in counseling or prescribing for adults than do family physicians or internists. They need to learn new behavior modification skills and perhaps to become more familiar with the pharmacological agents available to parents who want to quit. It is probably unusual for representatives of drug companies to visit pediatricians to discuss the patch or other drugs used for adults with nicotine dependence.

Further evidence of the need to educate providers in public and quasi-public facilities is the absence of references to ETS in the performance measures selected by the state MCH agencies. More attention to this problem by the federal Maternal and Child Health Bureau, which supports local child health services through its state grants, as well as by the Bureau of Primary Health Care, which supports community health centers, should lead to more active monitoring, counseling, and educating at the local level.

The ETS education activities of clinicians can be made easier and more effective by various office systems. Dicke, Gemson, and Carney (1999) describe two components of such a system: tools and teamwork. The tools that can assist providers with assessments include questionnaires that can be completed by patients; prompting and reminding materials such as chart stickers, checklists, and reminder letters; and educational materials. Also, coordination and delegation of tasks between clinicians and members of
their staffs can increase the number of parents who can receive assistance and the intensity of the intervention.

**Reimbursement.** Numerous policy statements and the Public Health Service’s clinical practice guideline have urged insurance reimbursement for tobacco dependence treatments identified as effective. *Healthy People 2010* (USDHHS, 2000a) lists “increase insurance coverage of evidence-based treatment for nicotine dependence” as one of its objectives. Yet few providers receive payment for services directed at children’s ETS exposure, and this remains a major barrier to counseling, especially in the private sector. Ibrahim, Schaffler, Barker, and Orleans (2002) surveyed state Medicaid tobacco dependence treatment policies, including those under their federally mandated Early and Periodic Screening, Detection, and Treatment programs. Only four states covered counseling for parents who smoke, only six required providers to conduct health education with parents who smoke, and only six required providers to screen parents for tobacco use. Eleven states, however, covered some form of pharmacotherapy for tobacco dependence.

More research is needed to convince insurers that the investment in such counseling programs will pay off. Certainly the literature reviewed in this article suggests that counseling programs show promise but do not yet provide unequivocal evidence, and the Public Health Service’s clinical practice guideline and the CDC’s Task Force on Community Preventive Services appear to agree. This doubt about the effectiveness of counseling programs is reflected in the fact that more Medicaid programs pay for pharmacological therapies than for counseling and education. If more pediatricians were convinced of the value of education and counseling and devoted more time to it, private insurers and Medicaid might be convinced to cover these services. In an *Archives of Pediatrics & Adolescent Medicine* editorial, Christakis (2001) stated, “There are notoriously few things that we do as part of well-child care for which there is sound evidence of benefit. Smoking cessation counseling is among them. We should make it a priority for our patients. It is time well spent.” This opinion contrasts with Berman’s 2003 editorial in the same journal that raised questions about the balance between caring for parents vs. caring for children. He called for operational research “to determine effective, efficient educational approaches that are minimally time-consuming.”

**Institutional support.** Professional organizations including medical, nursing, and public health groups should be encouraged to prepare and distribute policy statements that either deal with ETS exclu-

**Specialized programs.** Some caregivers will need more than the education and counseling available in private offices and clinics. They will need intensive clinical interventions provided by specialists in tobacco dependence treatment. Such specialists may work in private offices or in community agencies, and they serve as a back-up to primary care clinicians, allowing them to arrange for the care of those who want to quit but are unable to do so successfully on the basis of their physician’s intervention only. Efforts should be made to develop such services in areas with large numbers of smokers and no facilities. Such intensive clinical services should be reimbursed by private and public insurers.

**Community education**

The work of the clinicians interacting with smoking parents is easier when it occurs in communities and among populations already aware of the dangers of ETS to infants and children. The general public appears more knowledgeable about the adverse effects of smoking on adults and adolescents and about the problems associated with smoking during pregnancy than about children’s ETS exposure. The large number of pregnant smokers who do not tell their prenatal care providers about their habit, even when asked, suggests that they know they are doing
something they should not. Fewer families, however, seem aware of the consequences of smoking around young children.

The mass media should make the general public, especially women and men of childrearing age, aware of this problem. Certainly one place where this message should be included is in the warning messages on cigarette labels and on all cigarette advertising, including billboards. Telephone quit lines, on which smoking parents can receive advice about reducing their smoking and encouragement for their efforts, are an inexpensive adjunct to office-based interventions.

Regulatory policies

Additional states and localities need to pass and enforce laws and regulations prohibiting smoking. Bars and restaurants appear to have been the main targets to date, reflecting concern about adult ETS exposure. More states and localities should focus on child care centers, grocery stores, and other places where young children might be exposed. Progress is being made in this area, albeit slowly. But even Kentucky, South Carolina, Tennessee, and other tobacco-growing states are now increasing taxes on cigarettes and banning smoking in some places (Halbfinger, 2003).

Research

Finally, a great deal still must be learned about how to reduce children’ ETS. The National Institutes of Health, the Robert Wood Johnson Foundation, and other groups are funding such studies, but fewer of them are being conducted than in other areas of tobacco control. Research is needed on the prevalence and determinants of ETS exposure; home policies concerning smoking; the identification of the most at-risk populations; and provider knowledge, attitudes, and practices and the most effective ways of improving them, including various types of training programs. Communication studies are needed to determine the most convincing messages for alerting parents to the dangers of ETS and the best ways to transmit these messages. Household monitoring devices that would alert parents to the levels of smoke to which their children are being exposed might be an effective motivational tool. Randomized trials of various office- and community-based interventions will continue to be essential in order to establish a standard for practice.

Conclusions

Reducing children’s exposure to ETS will not be easy, but it is essential. Much progress has been made over the past decade, but additional efforts are needed to reduce this preventable source of childhood morbidity and mortality and to meet the Healthy People 2010 objective of having only 10% of children in the United States regularly exposed to tobacco smoke at home.

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