

## gOPINION EDITORIAL VIEWPOINT

# Pediatric Secondhand Smoke Exposure: Systematic Multilevel Strategies to Improve Health

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The World Health Organization estimates that, worldwide, more than 50% of children experience secondhand smoke exposure (SHSe) daily, with higher rates of exposure observed in medically underserved populations [1,2]. There is no safe level of SHSe, and routine exposure greatly increases the probability that children will initiate smoking themselves [3–5]. Children's SHSe is linked to sudden infant death syndrome and numerous acute illnesses (e.g., otitis, respiratory infections), as well as asthma, cancers, and cardiovascular disease—increasing cardiovascular disease risk by as much as 20% [6,7]. In addition to the direct harmful effects of SHSe on cardiovascular health [6,8–10], SHSe negatively affects children's diets, activity levels, and percentage of body fat [11,12], which can further impair their cardiovascular health.

### SYSTEMATIC INTERVENTION

Reducing children's SHSe has become a global public health priority [13]. Because children's SHSe is influenced by multiple factors and occurs across multiple contexts, it is understandable that any single SHSe-reduction approach will have limited effectiveness. For example, interventions that target a particular facet of the SHSe problem (e.g., lack of knowledge about SHSe harm) might not address other relevant causes (e.g., parental nicotine dependence, limited enactment of smoke-free laws in public venues). To improve the impact, future efforts should consider comprehensive behavioral- and social-ecological approaches that can guide integrated multilevel approaches. Such approaches

can exploit strengths and minimize shortcomings of single-level, evidence-based approaches such as family-, healthcare provider-, community-, and wider population-level interventions, while building linkages across levels of intervention to facilitate interactive intervention effects. (For detailed descriptions of ecological models see references [14] and [15].)

In 2007, the National Cancer Institute called for better “adoption of evidence-based practices” and better connections across the broad range of stakeholders involved with tobacco control [16]. A similar charge came from the National Institutes of Health in 2009, with recommendations to advance the science of behavior change by testing comprehensive, multilevel approaches to tobacco smoking [17]. The following sections outline key levels of intervention and identify some challenges and opportunities across strategies.

### FAMILY-LEVEL INTERVENTIONS

The majority of children's SHSe occurs from parental smoking in the home and the car [2,18,19]. Thus, family intervention that promotes parental smoking cessation is a critical element in a comprehensive SHSe-reduction approach. Because parental readiness to engage in SHSe reduction efforts is often higher than their readiness to quit smoking [20], recent behavioral counseling trials in Western countries have aimed to facilitate home smoking bans as their primary objective while encouraging motivation and support to quit smoking as parents' smoke-free home goals are realized [21]. The

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implementation of more intensive counseling interventions for smoking parents in recent years is a direct response to evidence from earlier, less-intensive trials' nonsignificant effects [22–25] and growing concern about thirdhand smoke [26,27].

Unlike provider- and population-level interventions, family-level counseling strategies provide the intervention intensity necessary to promote lasting smoking behavior change and child SHSe reduction in the home. These interventions also have the unique capacity to adapt evidence-based strategies to a family's cultural and systems milieu. Family-level intervention outcomes and program sustainability can only be enhanced by bridging counseling strategies to other levels of intervention. For example, parents enrolled in smoking cessation programs that are linked as a known referral source in pediatric primary care can benefit from the ongoing advice and encouragement pediatricians can provide beyond the end date of a counseling program. An integrated, multilevel approach to protecting children from SHSe points to opportunities for pediatric healthcare providers to improve the quality of advice to parents about SHSe reduction, as well as the frequency of: (1) referring parents to existing smoking cessation programs; (2) assisting parents in acquiring nicotine withdrawal aids; and (3) offering ongoing follow-up and support for behavior change challenges and maintenance of treatment gains.

### CLINIC-LEVEL, PROVIDER INTERVENTIONS

Given the frequency of contact between pediatricians and parents [28], pediatric healthcare providers have many opportunities to address parental smoking. Parents view pediatric provider advice to be credible and brief advice about smoking cessation and reducing SHSe can motivate parents to consider smoking behavior change [29,30]. Even though most pediatricians are aware of public health service guidelines for parental tobacco intervention, they have yet to embrace their role in SHSe reduction and in helping parents quit smoking [31]. Pediatric provider adherence to tobacco intervention guidelines continues to lag because of many clinic-level barriers to implementation (e.g., perceived lack of time, lack of tobacco-specific training) and lack of confidence [20,24,29,32,33]. Clinic quality improvement

interventions have been implemented recently to improve provider advice to smoking parents [20,34]. However, even when the quality and frequency of advice improves, advice alone is insufficient to promote lasting smoking behavior change. There is an opportunity for clinic quality improvement programs to enhance the impact of provider-level interventions by integrating provider- or clinic-level advice with broader community-level approaches and more intensive family-level strategies. Such linkages could create reciprocal, interactive treatment effects that not only capitalize on providers' credibility, improve provider knowledge of referral resources, and exploit the continuity of care parents receive from providers, but also relieve providers from the burden of delivering the necessary, intense counseling components that promote sustained smoking behavior change.

### COMMUNITY-LEVEL INTERVENTIONS

Behavioral ecological models provide a framework that explains how social reinforcement of smoking restrictions and changes in smoke-free norms at one level (e.g., community) can contribute to changes in norms, attitudes about smoking, and smoking behavior at other levels (e.g., the home) [35]. Efforts at the community level can help bolster social norms that support the evidence-based consensus that SHSe is not healthy for anyone—children in particular. Efforts to promote broad shifts in pro-SHSe-reduction norms can include education on the dangers of smoking and exposure to SHS provided in school curriculums [36,37] as well as in afterschool programs and community-based children's clubs. Community-based child health promotion programs, such as Women, Infants and Children and Head Start can model smoke-free policies and encourage parents to do the same in their homes [38]. Voluntary smoke-free policies or smoke-free social events also help assimilate social norms that support SHSe reduction into routine community activities. In addition to active strategies at a community-level, broader, more implicit strategies can facilitate shifts in attitudes and beliefs toward SHSe-reduction norms. For example, smoke-free media campaigns have been effective in reducing SHSe as well as in modifying youth perceptions of tobacco use [39,40]. Media campaigns targeting at-risk communities also can help educate parents about the dangers of children's

SHSe and encourage the use of existing resources that may be available to them, such as telephone quit lines, quit support groups, or distribution of free or low-cost nicotine replacement therapy.

## POLICY INTERVENTIONS

Finally, policy interventions to promote smoke-free environments can serve as the backbone to this multilevel model. Policies that prohibit smoking in public places [41] have been successful in reducing exposure to secondhand smoke for youth [42]. Policies that create smoke-free environments in settings that children frequent, such as cars [43], daycare centers [44], public parks [45], and zoos [45] are necessary to ensure safe environments frequented by children. In the United States, state and local jurisdictions have implemented innovative efforts to explore additional protections such as smoke-free public housing [46]. Similar to community-based programs, smoke-free laws can promote shifts in perceived norms about smoking. Likewise, laws that promote SHSe reduction in public spaces can implicitly encourage parents to consider adopting family-level smoking restrictions or entering counseling to facilitate smoking cessation [47,48]. Finally, smoke-free laws provide the impetus for communities to encourage consistent smoke-free environments across public and private contexts—a goal endorsed by the U.S. Environmental Protection Agency [38] that is consistent with Institute of Medicine recommendations for tobacco-control treatment integration across systems [16].

## FUTURE MULTILEVEL INTERVENTIONS

The failure to develop multilevel approaches remains a critical barrier to progress in reducing children's exposure to SHS [49]. The next steps to improve services and programs designed to protect children from SHSe should comprise explicitly integrated, multiple points of intervention where behavioral science and health policy can address SHSe at the family, provider, and community levels [17]. Current approaches to intervention and control are limited in their potential impact when implemented at a single level, disjointed from other efforts conducted simultaneously. SHSe interventions must focus on environmental factors (e.g., smoke-free policies) [48,50], social factors (e.g., pediatrician recommendation) [51], individual factors (e.g., motivation to change, nicotine dependence, coping skills training) and family systems factors (e.g., family norms and support for smoking behavior change) [21,22].

Intervention research and policy experts recognize that in many underserved and low-income communities, lack of resources may impede near-term implementation of multilevel tobacco-control strategies. In such communities, the implementation of SHSe-reduction efforts at any single level of intervention will be a critical and positive first step to protecting children. Nonetheless, even initial SHSe-reduction efforts can avoid simplistic action plans by acknowledging the multifactorial nature of SHSe and working toward long-term goals that expand single-level actions into more comprehensive programming.

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