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Adverse childhood experiences and smoking status in five states ☆

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ABSTRACT

Objective. Our objective was to examine the associations between adverse childhood experiences (ACEs) and smoking behavior among a random sample of adults living in five U.S. states.

Methods. We used data from 25,809 participants of the 2009 Behavioral Risk Factor Surveillance System to assess the relationship of each of the 8 adverse childhood experiences and the adverse childhood experience score to smoking status.

Results and conclusions. Some 59.4% of men and women reported at least one adverse childhood experience. Each of the eight adverse childhood experiences measures was significantly associated with smoking status after adjustment for demographic variables. The prevalence ratios for current and ever smoking increased in a positive graded fashion as the adverse childhood experience score increased. Among adults who reported no adverse childhood experiences, 13.0% were currently smoking and 38.3% had ever smoked. Compared to participants with an adverse childhood experience score of 0, those with an adverse childhood experience score of 5 or more were more likely to be a current smoker (adjusted prevalence ratio (aPR): 2.22, 95% confidence interval [CI]: 1.92–2.57) and to have ever smoked (aPR: 1.80, 95% CI: 1.67–1.93). Further research is warranted to determine whether the prevention of and interventions for adverse childhood experiences might reduce the burden of smoking-related illness in the general population.

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Introduction

Despite impressive declines in the prevalence of cigarette smoking among adults in the United States from 42.4% of adults in 1965 to 20.6% in 2009 (Centers for Disease Control and Prevention, 2010d), smoking continues to exact a heavy toll on morbidity and mortality in the United States (Centers for Disease Control and Prevention, 2010c; Danaei et al., 2009; McGinnis and Foege, 1993; Mokdad et al., 2004). Furthermore, the economic costs attributable to smoking were estimated at $96 billion per year in direct medical expenses as well as more than $97 billion annually in lost productivity during 2000-2004 (Centers for Disease Control and Prevention, 2010c).

The decline in smoking in the United States owes much of its success to efforts of clinicians, public health initiatives, and legislation. The release of the Surgeon General's Report in 1964 generated a number of activities to reduce the prevalence of smoking (U.S. Public Health Service, 1964). Warning labels were added to packs of cigarettes, sale of tobacco products to minors was prohibited, advertising campaigns educated the public about the health risks of smoking and dissuaded people from initiating smoking or advised them to quit smoking, and smoking in public places has been prohibited in some states, municipalities, and individual workplaces. A recent review suggests that a physician's advice to a patient to quit smoking is effective among a certain percentage of patients (Bodner and Dean, 2009). The use of nicotine patches or other pharmaceutical products also helps some patients to quit smoking (Moore et al., 2009).

Despite the success of these efforts, 20.6% of adults in the United States continue to smoke; this estimate has not changed much from the prevalence of 20.9% in 2005 (Centers for Disease Control and Prevention, 2010d). Understanding the factors that contribute to the initiation and continuation of smoking is critical to designing policies and practices that will be effective in reducing the prevalence of smoking. In 1999, Anda et al. (1999) reported that adverse childhood experiences (ACEs) were a novel contributing factor to smoking initiation in adolescence and smoking continuation in adulthood. In that study, the prevalence of having at least one ACE was 63%, and the prevalence of current smoking increased as the numbers of ACEs increased. Adults who reported having five or more ACEs had 5 times the odds of having started smoking at an early age, 3 times the odds of having ever smoked, and 2 times the odds of being a current smoker.

☆ Disclaimer: The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Since then, several additional cross-sectional studies have reported that ACEs are associated with smoking behavior with reported odds ratios of 3.5 for ever smoking, 4.0 for current smoking, and 1.55 to 2.0 for smoking initiation after various adjustments (Jun et al., 2008; King et al., 2006; Nichols and Harlow, 2004; Spratt et al., 2009). Furthermore, a panel study of African Americans found that child maltreatment in terms of neglect, physical abuse, and sexual abuse predicted smoking status (Topitzes et al., 2010).

Prospective data from the Kaiser-CDC (Centers for Disease Control and Prevention) ACE Study cohort supports the cross-sectional data. Follow-up of the Kaiser-CDC ACE Study cohort has shown that the number of ACEs was positively related to the incidence of smoking-related lung disease. Hospitalization rates for chronic obstructive pulmonary disease (COPD) and rates of prescription medications used to treat COPD increased as the ACE score increased (Anda et al., 2008). Similarly, hospitalization and death rates from lung cancer increased as the ACE score increased (Brown et al., 2010). In both of these studies, the relationship of the ACE score to COPD and lung cancer were partially mediated by smoking.

Because the initial findings about ACEs and smoking came from a study of enrollees of a large health maintenance organization in California, confirming these observations among a more diverse group in the general population is important to gauge the need for new clinical and public health practices to deal with smoking behaviors that are influenced by ACEs. Therefore, we examined the associations between ACEs and smoking status in a large sample of adults living in five geographically and demographically diverse U.S. states.

Methods

We used data from the 2009 Behavioral Risk Factor Surveillance System (BRFSS) (Centers for Disease Control and Prevention, 2010a). The BRFSS is conducted in all 50 states, the District of Columbia, and three territories. In each state, an independent probability sample from noninstitutionalized adults aged ≥18 years with telephones was selected by using disproportionate stratified sampling (Centers for Disease Control and Prevention, 2006). All states used an identical core questionnaire administered over the telephone by trained interviewers. However, states typically select different sets of optional modules of questions about emerging public health issues.

The choice of terminology and questions used in the BRFSS ACE module are based on the methods of the Kaiser-CDC ACE Study, in which all questions about ACEs pertained to the respondents' first 18 years of life (Anda et al., 1999). Questions used to define exposure to childhood emotional or physical abuse were adapted from the Conflict Tactics Scale (Strauss and Gelles, 1990), and sexual abuse was assessed using questions from Wyatt (Wyatt, 1985). In addition, 5 exposures to household dysfunction during childhood were: witnessing domestic violence (Strauss and Gelles, 1990); exposure to substance abusing (Schoenborn, 1995); mentally ill household members; parental separation or divorce; or having an incarcerated household member (Anda et al., 1999).

The BRFSS ACE module included 11 questions that were grouped into 8 abuse or household dysfunction categories (Appendix). Although largely similar to questions in the original Kaiser-CDC ACE study, cognitive testing with focus groups was conducted for the new questions included in the BRFSS in order to tailor them for telephone survey use (Centers for Disease Control and Prevention, 2010b). As a result, the wording of some of the questions differs somewhat from those used in the Kaiser-CDC ACE Study but accurately reflects their origins in the original Kaiser-CDC ACE Study. In 2009, the BRFSS ACE module was implemented by Arkansas, Louisiana, New Mexico, Tennessee, and Washington. The Council of American Survey Research Organizations (CASRO) response rates for these five states were 50%, 53%, 60%, 52%, and 48%, respectively.

Participants were defined as current smokers if they had smoked at least 100 cigarettes during their life and currently smoked some days or every day. Participants were identified as former smokers if they had smoked at least 100 cigarettes during their life but reported not smoking at the time of the interview. Participants were identified as never smokers if they had not smoked at least 100 cigarettes during their life. Participants who were current smokers or former smokers were also combined into ever smokers.

Covariates in our analyses were age, gender, race or ethnicity, and educational status. These covariates are described in Table 2.

We limited the analyses to men and women aged ≥18 years who responded to all 11 ACE questions. We calculated the prevalence of current smoking according to exposure to each of the 8 ACEs (yes/no). Because ACEs tend to be highly interrelated (Anda et al., 1999; Dong et al., 2004), the number of categories of ACE exposures was summed to create an ACE score (range: 0–8). The ACE score has been shown to be statistically valid (Dong et al., 2004) and has repeatedly been shown to have a positive graded relationship to a variety of important health and social problems (Anda et al., 2010). The association between ACEs and smoking status was examined by calculating prevalence ratios that were unadjusted and adjusted for the above listed covariates using log-binomial regression models. We used SUDAAN (Software for the Statistical Analysis of Correlated Data) for analyses to account for the complex sampling design. Percentages and prevalence ratios were calculated using the sampling weights.

Results

Of the 29,212 participants in the five states that administered the ACE questionnaire, 26,229 (90%) provided responses to all 11 questions used to create the ACE score. Of these 26,229 participants, 26,139 had information to establish smoking status. After excluding participants with missing values for a covariate, 25,809 participants were included in the analysis.

Reporting at least one ACE was relatively common: 40.6% reported no ACE, 22.4% reported one, 13.1% reported two, 8.8% reported three, 6.5% reported four, and 8.7% reported five or more ACEs. The unadjusted prevalence of current, former, and never smoking was 18.8%, 26.2%, and 54.9%, respectively. Compared with participants who had never smoked, those who were current or former smokers had a higher prevalence of each individual ACE and a greater number of ACEs (Table 1).

The unadjusted prevalence of experiencing one or more ACE and the prevalence of current smoking varied significantly among levels of many of the covariates (Table 2). There were inverse relationships for both variables with increasing levels of age and education (all $p < 0.001$). Women had a higher prevalence of at least one ACE ($p = 0.008$) and a lower prevalence of current smoking ($p = 0.003$) than men. Hispanics had a lower prevalence of at least one ACE and a lower prevalence of smoking than other racial or ethnic groups.

The crude prevalence of current smoking was significantly associated with each individual ACE category (Table 3). After adjustment for the sociodemographic characteristics, significant associations for current smoking were observed for each ACE category with adjusted prevalence ratios ranging from 1.31 to 1.54.

The prevalence of current smoking increased progressively as the ACE score increased (Table 4). This relationship was observed among both men and women. Compared with participants who reported no ACEs, the adjusted prevalence ratios increased steadily as the number of ACEs increased (Table 4). Participants with 5 or more ACEs were 2.22 (95% CI: 1.92–2.57) as likely to be a current smoker as participants with no ACEs. For analyses of ever smokers, the prevalence ratios also increased progressively as the number of ACEs increased, although the prevalence ratios were smaller than those for the analyses involving current smokers. Among ever smokers, the unadjusted percentage of former smokers was inversely related to the ACE score. After adjustment, however, only participants with an ACE score of 5 or more were significantly less likely to have quit smoking than participants who had an ACE score of 0.

Discussion

Population-based data from the BRFSS demonstrated a strong link between ACEs and smoking status. Moreover, as the ACE score increased, the risk of current smoking and ever smoking increased. Our analyses provide support for the previous findings of the Kaiser-