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The mediating role of depressive symptoms in the relationship between adverse childhood experiences and smoking

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HIGHLIGHTS

- Adverse childhood experiences are a risk factor for depressive symptoms in adults.
- ACEs are also a significant risk factor for cigarette smoking in adults.
- The relationship between ACEs and smoking is partially mediated by depression.
- Results were significant only for Asian, Hispanic, and White adults in the sample.

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ABSTRACT

Purpose of the Study: Adverse childhood experiences (ACEs), including various types of abuse and other forms of household dysfunction (i.e. witnessing domestic violence, parental substance abuse, etc.), have been consistently linked to increased rates of health risk behaviors and negative health outcomes in adulthood. Using data from the 2010 Centers for Disease Control and Prevention's (CDC) annual, nationwide Behavioral Risk Factor Surveillance System (BRFSS) telephone survey, this study tested whether self-reported symptoms of depression mediate the significant relationship between the number of ACEs an individual reports (expressed as an "ACE score") and whether they are a current or past smoker.

Methods: A path model was produced using multiple regression, and indirect effects were tested using bootstrapping of 2000 samples.

Results: Results of analyses indicated that, among White, Asian, and Hispanic participants, self-reported depressive symptoms are indeed a significant, but only partial, mediator between participants' ACE score and their smoking status.

Conclusions: These results suggest that for smokers of White, Hispanic, and Asian ethnicity, screening for a history of ACEs and treatment for depressive symptoms may be indicated. However, while depressive symptoms may explain some of the associations between ACEs and smoking, these results suggest that other, unexamined factors also contribute to this pathway.

1. Introduction

Adverse childhood experiences (ACEs), including various forms of abuse and other types of household dysfunction, have been identified as critical predisposing factors for health risk behaviors in adulthood and heightened risk for a wide array of diseases and consequent early mortality. Data from a large sample of HMO members collected in the seminal Kaiser-CDC ACE Study indicated that a history of these experiences is prevalent in the U.S. adult population, with more than half of adults reporting at least one ACE, and more than 13% reporting three or more (Felitti et al., 1998). This study also found that ACEs have a cumulative negative effect on health; the more ACEs an individual experiences, the higher his or her risk for adverse outcomes (Brown et al., 2009; Dong et al., 2004; Felitti et al., 1998).

Cigarette smoking is one of the most hazardous health risk behaviors common in the United States and is the country's leading cause of preventable death. Despite its well-known risks, as of 2010 it was estimated that nearly 20% of U.S. adults were smokers (CDC, 2012). A history of ACEs is related to rates of ever smoking, heavy smoking, and smoking related diseases (Anda et al., 1999; Brown, Lewinsohn, Seeley, & Wagner, 1996). Data from the 2009 Behavioral Risk Factor Surveillance System (BRFSS) indicated that smoking rates increase as the number of ACEs reported increases, and that individuals reporting five or more ACEs are more than twice as likely to be smokers as those reporting none (Ford et al., 2011).

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While the link between ACEs and adverse health in adulthood is well established, the pathway whereby ACEs lead to increased risk for risk behaviors, diseases, and mortality is not fully understood. Anda, Butchart, Felitti, and Brown (2010) have proposed that the increased risk for smoking associated with a history of ACEs is mediated through depression; they describe smoking as a "logical, but probably unconscious, adaptation to depression" (Anda et al., 2010, p. 94). Depression may indeed play a role in this pathway, as it has been shown to be both an outcome of childhood trauma and an important contributing factor to smoking.

A history of ACEs, including maltreatment, has been found to dramatically increase rates of lifetime prevalence of depression, particularly for women (Chapman et al., 2004; Harkness & Lumley, 2008). In turn, a large body of literature has shown that negative affective states, particularly depressive symptoms, are associated with initiation of smoking (Brook, Cohen, & Brook, 1998; Escobedo, Reddy, & Giovino, 1998; Ferdinand, Blum, & Verhulst, 2001), transition from recreational to addictive smoking (Breslau, Peterson, Schultz, Chilcoat, & Andreski, 1998; McKenzie, Olsson, Jorm, Romaniuk, & Patton, 2010; Schleicher, Harris, Catley, & Nazir, 2009), and degree of nicotine dependence among smokers (Lerman et al., 1996). The mechanisms whereby depressive symptoms influence smoking behavior are undoubtedly multiple; however, one pathway that has been supported by empirical research is that of self-medication, or negative affect reduction (Chaiton, Cohen, O'Loughlin, & Rehm, 2010; McChargue, Spring, Cook, & Neumann, 2004; Repetto, Caldwell, & Zimmerman, 2005). However, it is important to note that the link between depression and smoking appears to be bidirectional, as a number of studies have found that smokers are at increased risk for developing depressive symptoms (Boden, Fergusson, & Horwood, 2010; Klungsoyr, Nygard, Sorensen, & Sandanger, 2006; Pasco et al., 2008).

In previous research, depression has indeed been found to partially mediate the relationship between ACEs and smoking (Edwards, Anda, Gu, Dube, & Felitti, 2007; Lewis et al., 2011; Topitzes, Mersky, & Reynolds, 2010). However, these studies have either relied on a dichotomous classification of maltreated vs. non-maltreated youth, not accounting for multiple trauma types or other forms of family dysfunction, and/or on a dichotomous measure of past depression, rather than a measure of symptomatology that could consider the role of subclinical levels of symptoms in explaining the link between ACEs and smoking.

2. Method and materials

2.1. Participants and procedure

This study utilized data from the Center for Disease Control and Prevention's 2010 annual BRFSS telephone survey, which is made available to the public on the CDC's website (Centers for Disease Control and Prevention, 2010a). The BRFSS collects information on health risk behaviors, preventive health practices, and health care access. Information about the BRFSS and downloadable data files are available at http://www.cdc.gov/brfss/. Data were included in this study from only the four states that administered both the "Adverse Childhood Experiences" and "Anxiety and Depression" optional modules of the BRFSS: Hawaii, Nevada, Vermont, and Wisconsin (CDC, 2010b). The total sample size from these four states was 20,711. In this sample, the mean age of respondents was 56.4 years old, 59.6% were female, and the ethnic/racial distribution was as follows: 72.5% White, non-Hispanic; 2.8% Black; 10.8% Asian; 3.8% Hispanic; 7.8% multiracial; 0.8% Native Hawaiian or Pacific Islander, 0.8% American Indian or Alaskan Native, and 0.7% Other.

2.2. Measures

2.2.1. BRFSS questionnaire

The BRFSS survey is administered over the phone by trained interviewers. In each state, an independent probability sample from non-institutionalized adults aged 18 years and older with telephones is selected using disproportionate stratified sampling (CDC, 2006). The survey includes core sections, which all states must administer, and a number of optional modules, which individual states decide whether to administer (CDC, 2006).

2.2.2. Smoking module

A number of studies have examined the reliability and validity of smoking measures on the BRFSS and have found them to be high and consistent. The reliability is high for whether an individual has ever smoked at least 100 cigarettes and whether they are a current smoker ($\kappa = 0.79$–0.94 and $\kappa = 0.83$–1.00, respectively), and slightly lower for being a former regular smoker ($\kappa = .58$–0.86). Research examining the reliability of retrospective smoking measures suggests that the lower reliability for former smoking may be due to former light smokers reporting that they were never regular smokers (Kenkel, Lillard, & Mathios, 2003). Studies examining the validity of BRFSS smoking questions have found that compared to biochemical measures, they have a sensitivity of 78% for men and 86% for women and a specificity of 97% for men and 96% for women (Nelson, Holtzman, Bolen, Stanwyck, & Mack, 2001).

2.2.3. Adverse childhood experiences module

This module included a total of 11 questions grouped into eight categories of abuse or household dysfunction (CDC, 2010b). All questions were based on questions used in the ACE Study (Anda et al., 2010; CDC, 2010b). All of the categories of abuse and household dysfunction used in the ACE Study and the overall ACE score were found to have kappa values of $\kappa = .41$–$.86$ and therefore are considered to have good ($\kappa = .40$–$.75$) or excellent ($\kappa \geq .75$) test–retest reliability as defined by Fleiss (1981) and moderate ($\kappa = .41$–$.60$) to substantial ($\kappa \geq .61$) test–retest reliability as defined by Landis and Koch (1977) (Dube, Williamson, Thompson, Felitti, & Anda, 2004).

2.2.4. Anxiety and depression module

The "Anxiety and Depression" module included a total of 10 questions asking how many days in the past two weeks respondents had experienced eight symptoms of depression and whether or not respondents had ever been diagnosed with an anxiety or depressive disorder (CDC, 2010b). Because this study was concerned with the presence of depressive symptomatology rather than the presence of a diagnosis, the two questions asking about diagnoses were not used. The module is based on the eight-item Patient Health Questionnaire (PHQ-8) depression scale, which consists of eight of the nine DSM-IV criteria for depressive disorders (American Psychiatric Association, 1994; Kroenke et al., 2009). The ninth item of the PHQ-9, which assesses suicidal or self-injurious thoughts, was not included in the BRFSS because telephone interviewers would not be able to provide adequate intervention if it were endorsed. Previous research shows that this item's deletion has only a minor effect on scoring of the measure (Huang, Chung, Kroenke, Delucchi, & Spitzer, 2006). The PHQ-9 has been shown to be valid and reliable as both a diagnostic and severity measure in both clinical and population settings, including when administered by telephone and with diverse ethnic groups (Huang et al., 2006; Pinto-Meza, Serrano-Blanco, Penarrubia, Blanco, & Haro, 2005).

2.3. Variables

2.3.1. ACE score

Following the methodology established in the ACE Study, an "ACE score" was summed for each participant representing the number of categories of adverse childhood experiences they reported, ranging from 0 to 8. The criterion used for each category of ACEs was based on that used in the ACE Study (Felitti et al., 1998). Because the BRFSS did