



## Research report

# Secondhand smoke exposure across the life course and the risk of adult-onset depression and anxiety disorder

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## ARTICLE INFO

## Article history:

Received 1 July 2014

Accepted 8 July 2014

Available online 18 July 2014

## Keywords:

Secondhand smoke

Mood disorders

Anxiety disorder

Major depressive disorder

## ABSTRACT

**Introduction:** The aim of this paper was to investigate the association between childhood and adulthood exposure to secondhand smoke (SHS) and depression, panic attack, and generalized anxiety disorder among adults in the United States over a 10-year period.

**Methods:** Data were drawn from the Midlife Development in the United States (MIDUS) Waves 1 and 2 (N=2053). Self-reported childhood and adulthood SHS exposure at Wave 1 (1994) was examined in relation to incident depression, panic attack, and generalized anxiety disorder 10 years later at Wave 2 (2005).

**Results:** Childhood SHS alone was not associated with mood and anxiety disorders in adulthood. Exposure to SHS in both childhood and adulthood was associated with increased depression and panic attack in adulthood. These associations did not appear to be due to confounding.

**Limitations:** SHS exposure was measured via self-report; biological data confirming exposure were not collected. More objective measures of SHS exposure are needed in future studies.

**Conclusions:** In summary, persistent exposure to SHS across the life course may be associated with increased risk of depression and panic attacks. Our results are consistent with prior findings and extend earlier results by showing a relationship between SHS exposure and mental health problems over time. Replication with biological measures of SHS over time is a necessary next step toward better understanding the pathways explaining these relationships.

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## 1. Introduction

Over the past decade, several states in the US have implemented a number of tobacco control policies in an effort to protect non-smokers from secondhand smoke (SHS<sup>1</sup>) exposure (Callinan et al., 2010). Although regulations typically extend to a variety of enclosed and open public places including restaurants, bars, workplaces, and even to university campuses, policies that regulate smoking behavior in private residences are rare and difficult to enforce. Some research has shown that states that have enacted strict smoking bans may actually stimulate similar clean-air environments in homes and in vehicles (Naiman et al., 2011), particularly when children are present (Zhang et al., 2012). Despite that, smoking in homes leaves non-smokers unprotected from SHS exposure (Shields, 2007) and evidence suggests that Hispanic, African American, and non-Hispanic white households with higher levels of adult smoking, older children, and lower levels of education may be

disproportionately affected (Mills et al., 2011). Moreover, young people now have the highest levels of exposure to SHS as smoking continues to be concentrated in the home (Hawkins et al., 2012; Shields, 2007). Approximately 35% of all children in the US live in a household with one or more regular smokers (King et al., 2009; Schuster et al., 2002) ( $\geq 1$  d/wk). More than four million youth ages 12–17 in the US lives with at least one adult who smokes in the home.

Although evidence of an association between SHS exposure and various physical health risks (e.g., asthma, cancer, and cardiovascular disease) is well documented, (Faught et al., 2009; Winickoff et al., 2010) new lines of research are investigating the link between SHS exposure and mental health (Bandiera et al., 2010, 2011; Hamer et al., 2010). Psychiatric disorders, particularly depression and anxiety disorders, have tremendous public health implications. Major depression is a leading burden of disease worldwide and will be the second leading cause of disability by 2020 (Murray and Lopez, 1996). Anxiety disorders are the most common mental health problems affecting the population (Kessler et al., 2005) and are associated with substantial morbidity, distress, work loss, and psychiatric, substance use and physical comorbidity (World Health Organization, 2010). While both genetic and environmental risk factors have been identified for

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depression and anxiety disorders, the etiology of these disorders still remains poorly understood.

One recent study has found strong associations between SHS exposure and increased depression among adults (Bandiera et al., 2010). These associations persist longitudinally and after adjusting for a range of confounding demographic and social factors. Despite the apparent public health implications of smoking and SHS exposure on adults, research in the past 25 years has attended to the critical acute and long-term ramifications of smoking and SHS exposure on children (Weitzman and Gittelman, 2011). Since several psychiatric disorders have an onset during childhood, (Merikangas et al., 2010a; Patel et al., 2007; Weitzman and Gittelman, 2011) it is crucial to evaluate the relationship between SHS exposure and mental health, particularly because of the high levels of SHS exposure among youth.

Two studies have examined the impact of SHS exposure on the risk of conduct disorder (CD) in youth (Braun et al., 2008; Fergusson et al., 1993). Both studies, one of which used parent-reported exposure and the other serum cotinine, found an association between SHS exposure and increased risk of CD in children. Another study reported a link between biologically confirmed SHS exposure and symptoms of major depressive disorder (MDD), generalized anxiety disorder (GAD), attention-deficit hyperactivity disorder (ADHD), and CD among children and adolescents (Bandiera et al., 2011). The association remained significant even after controlling for several demographic factors including race/ethnicity, gender, age, and physical health factors (e.g., migraine, asthma, hay fever, and maternal smoking during pregnancy). While several studies have adjusted for a variety of demographic, social, and physical health factors, no study to our knowledge has controlled for physical abuse or drug or alcohol use problems. Further, no study to date has separated out the relations between SHS exposure in childhood vs. adulthood, nor examined the dose–response relationship between exposure to SHS in childhood and adulthood on depression and anxiety disorders in adulthood over a 10-year span.

Thus, the current study will attempt to address some of the limitations of past research by employing a longitudinal design spanning over 10 years to examine the relationship between childhood and adulthood SHS exposure and the risk of incident depression and anxiety disorders in adulthood among a nationally representative sample of adults in the United States. The study will also examine the potential role of common causal risk factors including child abuse, smoking, and drug and alcohol abuse in these relationships.

## 2. Methods

### 2.1. Sample

Data were drawn from the two waves of the Midlife Development in the United States Survey (MIDUS) (Brim et al., 2010). The MacArthur Midlife Research Network collected Wave 1 data from 1994 to 1995 and Wave 2 data from 2004 to 2006; a national survey of Americans in adulthood that investigated behavioral, psychological, and social factors related to physical and mental health. Wave 1 consisted of a nationally representative multistage probability sample (main sample) of community-dwelling English speakers in the continental United States ( $n=3032$ ). Participants who completed the telephone interview were mailed a self-administered questionnaire. The response rate from the mailed questionnaire was 86.6%, yielding an overall response rate of 61% ( $0.70 \times 0.87 = 0.61$ ). Approximately 70% of Wave 1 participants took part in the Wave 2 survey collected by the Institute on Aging at the University of Wisconsin–Madison and supported by the National

Institute on Aging (2004–2006). Wave 2 participants completed a 30-min telephone interview and a self-administered questionnaire was mailed to them. Of the 3032 participants from Wave 1, 2101 completed the Wave 2 telephone surveys (response rate of 69.5%). For this study, we analyzed only data from those who participated in the Wave 1 main sample who completed both the phone and mail-in surveys, participated in the Wave 2 survey, and had complete information for Wave 2 outcome variables.

### 2.2. Measures

#### 2.2.1. Secondhand smoke exposure

For childhood SHS exposure, at Wave 1, all participants were asked, “When you were growing up, that is during your first 16 years, did you live with anyone in your household who smoked cigarettes or other tobacco products (other than yourself)?” Possible responses included *no*, *father*, *mother*, and *someone else*. Those who responded affirmatively to living with anyone who smoked in the household were considered exposed to SHS as a child. For adulthood SHS exposure, at Wave 1, all participants were asked, “At the current time, does anyone regularly smoke cigarettes or other tobacco products INSIDE your home [other than yourself]?” Those who responded in the affirmative were considered to have SHS exposure in adulthood.

#### 2.2.2. Cigarette smoking

At each Wave (1 and 2), all participants were asked if they had ever smoked a cigarette. Those who responded affirmatively were asked whether they currently “smoked regularly—that is at least a few cigarettes a day.” Participants who responded affirmatively were included as those with a history of daily smoking.

#### 2.2.3. Depression and anxiety disorders

The MIDUS psychiatric diagnoses were based on the Composite International Diagnostic Interview Short Form scales, a series of diagnostic-specific scales that were developed from item level analyses of the Composite International Diagnostic Interview questions in the National Comorbidity Survey (Costa and McCrae, 1988; Kessler et al., 1994). The Composite International Diagnostic Interview Short Form scales were designed to reproduce the full Composite International Diagnoses as exactly as possible, with only a small subset of the original questions. Composite International Diagnostic Interview Short Form diagnoses at 12 months included in the MIDUS were MDD, panic attacks (PA), and GAD. These measures were used in Wave 1 past-12 month disorders.

#### 2.2.4. Child maltreatment

Physical abuse categories were modeled after the Conflict Tactics Scale (Straus, 1979) using 15 different item measures from the MIDUS self-administered questionnaire. Respondents were asked how frequently their mother or father smashed or kicked something in anger; pushed, grabbed, or shoved them; slapped them; threw something at them; kicked, bit, or hit them with a fist; hit or tried to hit them with something; beat them up; choked them; burned or scalded them. Since physical response categories ranged in frequency from *never* to *often* for each (*mother and father*), respondents who reported experiencing abuse as *sometimes* or *often* were coded as 1 and those who reported *never* or *rare* were coded as 0.

#### 2.2.5. Statistical analyses

Data were managed and analyzed with SPSS version 21.0 (IBM Corp., 2012). Descriptive statistics for the variables of interest as well as for potential confounders were generated. We used cross-tabulation to

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