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Accuracy of a Brief Screening Scale for Lifetime Major Depression in Cigarette Smokers Revised Manuscript December 8, 2010

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Abstract

History of major depression is increasingly being measured in smoking cessation trials using brief screening scales, typically only 1–2 items, despite that their validity has not been fully established. The aim of this study was to evaluate the positive predictive value (PPV) of a 4-item screening scale of lifetime major depressive episode (MDE). Current (n=475), former (n=401), and never (n=646) smokers were asked about a history of depressed mood and anhedonia lasting several days or longer. Endorsers of either depressed mood or anhedonia were then asked about whether the symptom(s) lasted most of the day nearly every day for two weeks or longer. Symptom endorsers, regardless of symptom duration, were administered the depression module of the Composite International Diagnostic Interview. Eight hundred and thirty-five (54.9%) participants had no history of either screening symptom, 296 (20.9%) had a history of depressed mood and (or) anhedonia <2 weeks, and 369 (24.2%) had a history of depressed mood and (or) anhedonia ≥2 weeks. PPV of depressed mood and (or) anhedonia ≥2 weeks was high (84.8%) for detecting lifetime MDE, as compared to only 23.9% for symptom(s) <2 weeks. PPV did not vary by either smoking status or gender. This 4-item screening scale has high predictive value in detecting lifetime MDE. Smoking cessation trials that do not require a history of depressed mood and (or) anhedonia for two weeks or longer may overestimate rates of lifetime MDE and confound tests of the association between depression and treatment outcome.

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Keywords

Depression screening; Positive predictive value; Major depressive episode; Depression prevention; Tobacco use treatment

Introduction

We investigated the predictive validity of a brief screening scale for lifetime major depressive episode (MDE) and whether the validity of the screening scale differs among current, former, and never smokers. The problem of tobacco use and dependence among people with past major depression has been well documented (see Ziedonis et al. 2008). The presence of lifetime MDE is therefore of substantial interest in smoking cessation treatment studies – for example, for determining whether persons with a history of MDE respond differentially to treatment (Hitsman et al. 2003), in part because of greater withdrawal-related dysphoria or tobacco craving.

Brief measures, typically 1–2 item scales adapted from validated diagnostic interviews, such as the Composite International Diagnostic Interview (CIDI; Kessler, Wittchen, & Abelson, 1998) are increasingly being used to screen for history of MDE. The demands of full diagnostic interviews (i.e., doctoral-level expertise, administration time ranging from 45–90 minutes), combined with the increased emphasis on community-based effectiveness trials of large populations of smokers, make this level of assessment increasingly impractical. The validity of brief scales has been demonstrated for current major depression (Cuijpers et al., 2009; Kroenke et al., 2003) but not lifetime. Given the relevance of lifetime major depression to smoking cessation research and addiction research more generally, it is important to evaluate the validity of screening scales, especially among smokers who are twice as likely as non-smokers to have a history of MDE (Breslau & Johnson, 2000). Nearly 75% of people with a history of major depression will experience multiple episodes over their lifetime (Hollon et al. 2006).

For a lifetime diagnosis of MDE, some smoking cessation trials have required the endorsement of a history of depressed mood and (or) anhedonia (Wetter et al. 1999; Niaura et al. 1999), whereas others have required depressed mood and (or) anhedonia ≥ 2 weeks, consistent with Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV) criteria for lifetime MDE (Aveyard et al. 2008; McClure et al. 2009; Parsons et al. 2009; Swan et al. 2003). Other studies have even classified lifetime depression based on the simple endorsement of a “history of depression” (Carmody et al. 2008) or on whether the smoker was ever told by a medical provider that s/he had depression (Simon et al. 2009).

A study by McChargue and Werth-Cook (2007) examined the validity of using two single items (depressed mood, anhedonia) to screen for DSM-IV lifetime MDE in 77 smokers. Among participants who endorsed “ever feeling down or depressed most of the day nearly every day for 2 weeks or more”, 88% (28 of 32) met criteria for lifetime MDE. Predictive value was lower for anhedonia. Only 67% (24 of 36) of those who endorsed having “ever lost interest or pleasure in things you typically enjoy most of the day nearly every day for 2 weeks or more” were diagnosed with lifetime MDE. Given the small and possibly targeted sample (the study was advertised as a study examining how urges to smoke a cigarette are affected by negative moods; D.E. McChargue, personal communication, September 5, 2008), further research is needed to establish the validity of screening scales of lifetime MDE among the general population.

The primary aim of this study was to evaluate the positive predictive value (PPV) of a 4-item screening scale of lifetime MDE among a community sample of 1,522 participants in the New England Family Study. This scale is novel in that it requires either of the core symptoms of MDE (depressed mood or anhedonia) and a duration of at least two weeks. Given that the PPV of a screening scale is related to the underlying prevalence of the disorder (Altman & Bland, 1994), and that the risk of depression is higher among smokers, we evaluated whether PPV was influenced by smoking status. A secondary aim was to compare smokers who screened positive versus negative for history of depressed mood and (or) anhedonia ≥ 2 weeks on factors that predict smoking cessation treatment outcome, including indices of tobacco dependence (Baker et al. 2007), current depressive symptoms (Ziedonis et al. 2008), history of persistent anxiety or worry (Piper et al. 2010), and alcohol use (Borland, 1990; Shiffman & Gwaltney, 2008).

Methods

Participants

Participants were offspring of pregnant women enrolled in the Collaborative Perinatal Project between 1959 and 1966 (Niswander & Gordon, 1972). The New England Family Study (NEFS) was established to locate and interview the adult offspring whose mothers were enrolled during pregnancy at the Providence, Rhode Island and Boston, Massachusetts sites. The NEFS was approved by the Institutional Review Boards of Harvard and Brown Universities. Participants were selected through a multi-stage sampling procedure, which aimed to recruit individuals for one of several follow-up studies focused on tobacco use (see Gilman et al. 2008). Data collection took place between 2001 and 2004. The sample for the present study was restricted to 1,522 of the 1,625 NEFS participants who had complete data on current/past tobacco use and the brief screening scale and diagnostic interview of lifetime MDE. Participants averaged 39 (SD=1.9) years-old and were mostly female (60.0%).

Measures

Smoking status—Smoking histories were obtained using the Life Interview of Smoking Trajectories, developed by the Brown-Harvard Transdisciplinary Tobacco Use Research Center. Ever regular smoking was assessed by the question, 'Did you ever become a weekly smoker (that is, smoke at least once per week for two months or longer)?' Current smokers endorsed ever regular smoking and reported currently smoking on average at least one day per week. Former smokers endorsed ever regular smoking but no current use. Participants who reported never becoming weekly smoker were classified as never smokers.

Brief screening scale of lifetime MDE—Participants were asked about a history of depressed mood (item 1) and anhedonia (item 2 or 3 depending on the response to item 1) lasting several days or longer. Endorsers of depressed mood or anhedonia were asked about whether the symptom(s) lasted most of the day nearly every day for two weeks or longer (item 4). The scale and wording of the four items are presented in Table 1.

Participants were classified as screen positive if they endorsed a history of symptom(s) lasting two weeks or longer. Those classified as screen negative were further divided into two groups: a) those who reported depressed mood and (or) anhedonia lasting less than two weeks; and b) those reporting neither symptom. The items comprising this scale are the first four items of the CIDI (Kessler, Wittchen, & Abelson, 1998) depression module.

Diagnostic interview of lifetime MDE—The full depression module of the CIDI was administered to diagnose lifetime MDE according to DSM-IV criteria (American Psychiatric Association, 2000). The CIDI is a validated structured interview designed to be administered

by trained lay interviewers (Haro et al., 2006). Interviews were conducted by bachelor-level research staff with extensive interviewing experience. All staff underwent standardized intensive training to administer the CIDI, including the depression module, and extensive quality control procedures were followed to ensure that it was administered properly.

Additional measures—Several measures were used to compare MDE screen positive and negative groups on factors that predict smoking cessation treatment outcome. These included the CIDI tobacco module, the Fagerstrom Test for Nicotine Dependence (FTND) (Heatherton et al., 1991), and the Center for Epidemiologic Studies Depression Scale (CESD) (Radloff, 1977). Also administered was a mental health history questionnaire comprised of screening items taken from other CIDI modules. Among other experiences, it assessed alcoholic drinks per day over the past year and history of persistent worry or anxiety (“Has there ever been a period of 6 months or more where you felt worried or anxious most days?”). The latter is considered a key feature of DSM-IV-defined generalized anxiety disorder (GAD; American Psychiatric Association, 2000). GAD has a high rate of co-occurrence with major depression (Simon, 2009) and was recently found to predict decreased response to smoking cessation treatment (Piper et al. 2010).

Procedure

Participants were classified as either current, former, or never regular smokers. Based on responses to the 4-item screening scale of lifetime MDE, participants were classified as “screen negative” – no history of depressed mood or anhedonia, depressed mood and (or) anhedonia <2 weeks, or “screen positive” – depressed mood and (or) anhedonia ≥2 weeks. The criterion standard for the diagnosis of lifetime MDE was diagnosis obtained via the full CIDI depression module. Participants who endorsed either depressed mood or anhedonia on the screening scale, regardless of symptom duration, were administered the full CIDI depression module. According to the structure of the CIDI, participants who did not endorse either symptom were skipped out of the remainder of the module.

Statistical Analysis

The primary analyses evaluated the PPV of the brief screening scale of lifetime MDE. PPV was calculated as the probability that screen positives had a lifetime diagnosis of MDE based upon the CIDI. For comparison, PPV was also calculated for participants who endorsed a history of depressed mood and (or) anhedonia <2 weeks (one of the two screen negative groups). PPV was evaluated for the overall sample and separately by smoking status and gender.

Chi-square analysis (Pearson) and analysis of variance (ANOVA) were used to test for differences among the three groups defined by the screening scale (no history of depressed mood or anhedonia, depressed mood and (or) anhedonia <2 weeks, and depressed mood and (or) anhedonia ≥2 weeks) on the measured smoking relapse risk factors. Pairwise comparisons for significant results were conducted using the Scheffé test (for continuous variables) and chi-square (for dichotomous variables). An alpha of .05 (two-sided) was used for all tests.

Results

Three hundred and eighteen participants (20.9%) endorsed a history of depressed mood and (or) anhedonia lasting <2 weeks, while 369 (24.2%) endorsed a history of depressed mood and (or) anhedonia lasting ≥2 weeks. Eight hundred thirty-five (54.9%) reported no history of either symptom. Table 2 displays the frequency of symptoms (depressed mood only, anhedonia only, depressed mood and anhedonia) by symptom duration. The overall

prevalence of lifetime MDE in the sample was 25.6% [women 29.8% (272/913), men 19.2% (117/609)]. As expected, ever smokers had a higher rate of lifetime MDE than never smokers [current 31.8% (151/475), former 26.2% (105/401), never 20.6% (133/646); $\chi^2(1)=18.1$, $p<.001$].

The probability of meeting full diagnostic criteria for MDE among participants who endorsed depressed mood and (or) anhedonia ≥ 2 weeks (screen positives) was high: 84.8% (313/369; PPV). In contrast, the probability of lifetime MDE among endorsers of symptom(s) <2 weeks was much lower: 23.9% (76/318). PPV of a history of symptom(s) ≥ 2 weeks did not vary by smoking status [$\chi^2(2)=2.48$, $p=.29$] or gender [$\chi^2(1)=0.17$, $p=.68$]. Screen positive participants were more likely to endorse ever talking to a doctor or other medical professional about their depression [86.3% vs. 76.3%; $\chi^2(1)=7.07$, $p=.01$], ever overnight hospitalization for depression [19.5% vs. 6.0%; $\chi^2(1)=10.06$, $p<.01$], and ever thoughts about suicide [47.1% vs. 31.8%; $\chi^2(1)=8.93$, $p<.01$]. The two groups reported comparable rates of professional treatment for depression in the past 12 months [50.5% vs. 49.0%; $\chi^2(1)=0.07$, $p=.79$].

With respect to smoking status, there were 475 current (31.2%), 401 former (26.4%) and 646 (42.4%) never smokers. Current and former smokers were comparable in terms of age of onset of weekly smoking [current smokers $M=16.0$ years-old, $SD=4.5$; former smokers $M=15.7$ years-old, $SD=3.7$; $t(869)=-.41$] and lifetime DSM-IV tobacco dependence [current smokers 70.8%, former smokers 65.0%; $\chi^2(1)=3.3$, $p=.07$]. Although the vast majority of both groups endorsed lifetime daily smoking, rates were higher among current (98.5%) than former smokers (91.6%) [$\chi^2(1)=23.2$, $p<.001$]. Current smokers reported on average 17 cigarettes per day [$M=17.3$, $SD=10.6$] with a mean FTND score of 4.3 ($SD=2.6$).

Because some smoking cessation trials have classified lifetime MDE based only on the endorsement of a history of depressed mood and (or) anhedonia, regardless of symptom duration, we compared current smokers who endorsed depressed mood or anhedonia ≥ 2 weeks ($n=140$) to those who endorsed these symptoms <2 weeks ($n=111$) and those with no history of symptoms ($n=224$) on several factors that predict smoking cessation treatment outcome. Analyses comparing the three groups of smokers revealed statistically significant differences on current depressive symptoms [$F(2, 242)=23.5$, $p<.001$], presence of DSM-IV tobacco dependence [$\chi^2(2, N=459)=17.0$, $p<.001$], degree of dependence as measured by the FTND [$F(2, 382)=6.9$, $p<.01$], and history of worry or anxiety for a period of six months or longer [$\chi^2(2, N=474)=121.7$, $p<.001$]. As shown in Table 3, the two groups of smokers who endorsed a history of symptoms scored comparably high on all of these relapse risk factors, with one exception. Participants with a history of symptom(s) lasting two weeks or longer endorsed the highest rate of past worry or anxiety for a period of six months or longer. There were no significant differences among the three groups in age [$F(2, 472)=7.1$, $p=.49$], gender [$\chi^2(2, N=475)=5.7$, $p=.06$], cigarettes smoked per day [$F(2, 410)=1.1$, $p=.34$], percentage smoking the first cigarette of day within five minutes of awakening [$\chi^2(2, N=403)=4.3$, $p=.12$], and number of alcoholic drinks per day over the past 12 months [$F(2, 323)=.03$, $p=.97$].

Discussion

Brief screening scales of lifetime MDE, such as the 4-item scale evaluated in this study, have high PPV in detecting lifetime MDE as long as they require a history of depressed mood and (or) anhedonia that persisted for two weeks or longer. Endorsement of symptoms lasting less than two weeks performed poorly. Our findings have implications for smoking cessation trials that use brief scales of lifetime depression. Studies that classify lifetime MDE based only on a history of depressed mood and (or) anhedonia and ignore symptom

duration may overestimate rate of lifetime MDE. Nearly half of participants in this study who endorsed one or both symptoms (318 of 687) endorsed a symptom duration of less than 2 weeks. More importantly, studies may overestimate the association between lifetime MDE and smoking abstinence because participants who endorse symptoms lasting less than two weeks score comparably high on certain relapse risk factors, including tobacco dependence and depressive symptoms, that predict treatment outcome (Baker et al. 2007; Hitsman et al. 1999; Hitsman et al. 2002; Kahler et al. 2002). In light of the increasing use of brief screening measures, a valid scale is needed to clarify the association between lifetime MDE and tobacco use and smoking cessation.

Our findings need to be evaluated in the context of potential limitations. Because the full CIDI depression module was only given to participants who endorsed a history of depressed mood or anhedonia lasting several days or longer on the 4-item screening scale, we were unable to evaluate other statistical indices of performance, such as sensitivity and specificity and negative predictive value. Although PPV was most relevant for our purpose, future work should evaluate these other aspects of performance. This would require administering the depression diagnostic module to all participants. Recent work has implied that assessment of lifetime MDE at a single time-point may underestimate true lifetime risk of depression, which is likely better evaluated by repeated interviews over time (Moffitt et al. 2010). Furthermore, the full CIDI itself has less than perfect concordance with semi-structured clinical interviews such as the SCID (Haro et al., 2006), which are considered to be the ideal criterion in psychiatric studies.

Accurate assessment of lifetime MDE has important implications for epidemiological studies of depression history and tobacco use and for clinical studies of depression history and smoking cessation. A meta-analysis by Hitsman et al. (2003) found no difference in treatment outcome between smokers with and without lifetime MDD, and several studies published since this review have also observed no association with abstinence (Brown et al. 2007; Covey et al. 2008; Hall et al. 2004; Levine et al. 2003; McClure et al. 2009). Other studies, however, have reported a negative relationship (Japuntich et al. 2007; Oncken et al. 2007; Swan et al. 2003), which raises the possibility that differences among studies in the measurement of lifetime depression may be an important modifier of the association with treatment outcome.

Brief assessment of lifetime MDE could be used to facilitate more efficient treatment matching for persons with a history of major depression, who comprise on average 35% of treatment samples (Hitsman et al. 2003). The 2008 update of the U.S. Public Health Service Practice Guideline for the treatment of tobacco use and dependence recommends either sustained release bupropion (Zyban®) or nortriptyline for smokers with a history of depression (Fiore et al. 2008). Both medications are also FDA-approved antidepressants. Additional evidence indicates that cognitive behavioral treatment involving mood management skills training may be an effective smoking cessation intervention for this high burden population (Muñoz et al. 1997; Patten et al. 1998), although more recent studies have observed this only among smokers with the far more common recurrent subtype Brown et al. 2001; Haas et al. 2004). For smokers either treated in general medical practice or as a part of treatment efficacy studies, the 4-item screener could be used to identify smokers who should receive more extensive evaluation of lifetime depression (e.g., CIDI). Among large scale smoking cessation effectiveness studies where a large population of smokers makes a full diagnostic evaluation unfeasible, the 4-item screener could serve as an acceptable alternative with which to guide smoking cessation treatment recommendations.

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Table 1**Brief screening scale of lifetime MDE**

1. Have you ever had periods of time that lasted several days or longer when you felt sad, empty, or depressed most of the day?
No (<i>Skip to item 3</i>)
Yes
2. During the episodes of being sad, empty, or depressed, did you ever lose interest or pleasure in most things like work, hobbies, or other things that you usually enjoy?
No (<i>Skip to item 4</i>)
Yes (<i>Skip to item 4</i>)
3. Have you ever had periods of time that lasted several days or longer when you lost interest or pleasure in most things like work, hobbies, or other things you usually enjoy?
No (<i>End of assessment</i>)
Yes
4. You mentioned having periods of time that lasted several days or longer when you [<i>were sad and (or) lost interest or pleasure in most things</i>]. Did you ever have a period of this sort that lasted most of the day nearly every day for two weeks or longer?
No
Yes

Table 2

Frequency of endorsed symptoms by duration and percentage meeting full diagnostic criteria for lifetime MDE

Symptom(s) duration	History of Symptoms			
	No Symptoms	Depressed Mood Only	Anhedonia Only	Depressed Mood + Anhedonia
Lasting several days or longer but less than 2 weeks	--	63 (9.5%)	42 (9.5%)	213 (31.0%)
Most of the day nearly every day for 2 weeks or longer	--	20 (55.0%)	11 (54.5%)	338 (87.6%)
Total	835	83	53	551

Note. The percentages meeting full diagnostic criteria for lifetime MDE are presented in the parentheses.

Table 3

Demographic, current smoking, and smoking relapse risk factors by among current smokers (n=475) who screened positive versus negative for depressed mood and (or) anhedonia

Characteristic	Screen Negative		Screen Positive	p
	No Symptom(s) (n=224)	Symptom(s) <2 Weeks (n=111)	Symptom(s) ≥2 Weeks (n=140)	
Age	38.9 (1.8)	39.1 (1.8)	38.8 (1.8)	.49
% female	56.3%	66.7%	67.1%	.06
Cigarettes per day	16.8 (11.2)	16.8 (10.0)	18.5 (10.1)	.34
1st cigarette ≤5 mins of waking	25.9%	29.5%	37.0%	.12
CIDI tobacco dependence	41.4%	60.2%	61.0%	<.001 ^a
FTND	3.8 (2.6)	4.5 (2.3)	4.9 (2.6)	<.001 ^a
CESD	9.2 (7.8)	15.7 (9.3)	19.2 (12.9)	<.001 ^a
% CESD ≥16	18.8%	47.1%	55.6%	<.001 ^a
Past worry or anxiety ≤6 mths	12.6%	37.8%	69.3%	<.001 ^b
Alcoholic drinks per day	3.7 (4.8)	3.8 (2.9)	3.8 (3.5)	.95

Note. The CESD was administered to a subsample of participants (n=798). The sample sizes for current smokers are as follows: no symptoms n=112, symptom(s) <2 weeks n=70, symptom(s) ≥2 weeks n=63. A score of 16 on the CES-D is the cutoff for possible MDE (Radloff, 1977).

^aSymptom groups > no past symptoms group (p <.05)

^bSymptom(s) two weeks or longer group > symptoms less than two weeks group > no past symptom group (p <.05)