Anxiety Sensitivity in Smokers with Indicators of Cardiovascular Disease

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Abstract

There is growing recognition of the importance of understanding the nature of the associations between anxiety and cardiovascular disease (CVD), although limited research has examined mechanisms that may explain the anxiety-CVD link. Anxiety sensitivity (fear of anxiety-relevant somatic sensations) is a cognitive-affective risk factor implicated in the development of anxiety psychopathology and various behavioral risk factors for CVD, although has not been examined among individuals with CVD. Adult daily smokers (n = 619; 50.9% female; Mage = 44.0, SD = 13.67) completed an online survey that included the Anxiety Sensitivity Index-3 (ASI-3) and the Patient Health Questionnaire (PHQ). The presence of CVD was assessed via the presence of   1 of the following: heart attack, heart murmur, positive stress test, heart valve abnormality, angina, and heart failure. Smokers with CVD indicators (n = 66, 10.7%) had significantly higher scores on the ASI-3 (M = 33.5, SD = 22.15), relative to smokers without CVD (M = 22.0, SD = 17.92; Cohen's d = .57). Those with CVD were significantly more likely to have moderate or high anxiety sensitivity (66.7%) relative to those without CVD (49.4%). Physical and social concerns about the meaning of somatic sensations were common among smokers with CVD.

Keywords

anxiety; nicotine dependence; cardiac; anxiety sensitivity

Introduction

Cardiovascular disease (CVD) is the leading cause of death in the United States (CDCP, 2014; Go et al., 2013). Anxiety disorders in patients with CVD increase the risk of mortality and recurrence of cardiac events by approximately two-fold (Edmondson et al., 2012; Tully, Cosh, & Baumeister, 2014). The associations between anxiety, CVD, and the perpetuation of

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these disease processes are likely (a) transactional and (b) occur directly and indirectly via shared bio-psychological vulnerability processes. One potential underlying psychological risk factor is anxiety sensitivity, defined as the extent to which individuals believe anxiety and anxiety-related sensations have harmful *consequences* (Reiss, Peterson, Gursky, & McNally, 1986). Anxiety sensitivity is a risk factor for the acquisition and maintenance of anxiety psychopathology (Olatunji & Wolitzky-Taylor, 2009), and while it is conceptualized as a relatively stable dispositional factor, anxiety sensitivity is malleable and serves as an explanatory mechanism in the treatment of anxiety (Smits, Berry, Rosenfield, et al., 2008; Smits, Berry, Tart, & Powers, 2008).

Theoretically, anxiety sensitivity may be elevated among individuals with CVD due to increased presence of physiological and autonomic disturbance (Kemp et al., 2012; Tully, Cosh, & Baune, 2013), which may serve as a prominent cue for perceived danger and risk (Jeejeebhoy, Dorian, & Newman, 2000; Korczak, Goldstein, & Levitt, 2007). Indeed, among non-cardiac patients, anxiety sensitivity is associated with greater cardiopulmonary fears (e.g., Aikens, Zvolensky, & Eifert, 2001). It is possible that anxiety sensitivity may contribute to risk for CVD through engagement in various health risk behaviors, like cigarette smoking (Leventhal & Zvolensky, 2015), emotional and binge eating (Anestis, Holm-Denoma, Gordon, Schmidt, & Joiner, 2008; Hearon, Utschig, Smits, Moshier, & Otto, 2013), and physical inactivity (Moshier, Szuhany, Hearon, Smits, & Otto, 2016). In addition, anxiety sensitivity may have a direct effect on CVD. For example, higher anxiety sensitivity is associated with increased likelihood carotid plaques and arterial stiffness among individuals without CVD (Seldenrijk et al., 2013). To our knowledge, no published studies to date have assessed anxiety sensitivity among individuals with CVD. Thus, the current study aimed to characterize the nature of anxiety sensitivity among smokers with self-reported indicators of CVD.

Prior data indicate that smokers report greater fear about cardiac sensations than non-smokers, and the combination of smoking and coronary artery disease (compared to ether alone) is associated with increased cognitive bias to cardiac sensations, even after adjusting for cardiac pain severity (Zvolensky, Eifert, Feldner, & Leen-Feldner, 2003). Therefore, we hypothesized that community-recruited smokers with CVD would have higher levels of anxiety sensitivity relative to smokers without CVD.

Method

Participants and Procedure

Participants (n=619; 50.9% female) were daily smokers who recruited through Qualtrics Online Sample for an anonymous study on smoking and health. Participants were included on the following criteria: (a) 18 years of age, (b) daily smoking for 1 year, (c) smoking 5 cigarettes/day, and (d) cigarettes as primary tobacco product. Participants were excluded if they reported reduced smoking rate by more than half in the past 6 months. The survey was approximately 40 minutes in length. Cases were retained on the basis of accurately answering four imbedded validity 'check' questions. The study protocol was approved by the Institutional Review Board where the study was conducted.

Measures

Items from the *Smoking History Questionnaire* (SHQ; Brown, Lejuez, Kahler, & Strong, 2002) were used to describe the sample in terms of smoking. *Cardiovascular disease and risk factor*s were assessed via a medical checklist of 34 different health conditions (yes/no). Six items were used to index presence of CVD: heart attack, heart murmur, positive stress test, heart valve abnormality, angina, and heart failure. The presence of ≥ 1 of these conditions was used to indicate CVD. Several health risk factors for CVD were also assessed including presence of *high blood pressure*, *high cholesterol*, and *diabetes* (yes/no). *Body Mass Index* (BMI) was calculated based on self-reported weight and height as an index of body weight ([weight(lbs)/[height (in)]^2 x 703]; WHO, 2002). The *International Physical Activity Questionnaire* (IPAQ; Craig et al., 2003) was used to denote average weekly number of moderate-to-vigorous physical activity minutes and sedentary time. The *Patient Health Questionnaire* (PHQ; Spitzer, Kroenke, & Williams, 1999) is a self-report assessment that was used to assess the presence/absence of common DSM-IV Axis I disorders (Spitzer et al., 1999). The *Anxiety Sensitivity Index-3* (ASI-3; Taylor et al., 2007) is an 18-item psychometrically-sound self-report measure of anxiety sensitivity. Responses are rated on a five-point Likert scale ranging from 0 (*very little*) to 4 (*very much*) and summed to create a total score (possible range 0–72) and three subscale scores (possible range 0–24) reflecting physical, cognitive, and social consequences of anxiety sensations. The ASI-3 is validated in smokers (Farris et al., 2015) and clinical cut-scores ≥ 17 indicate at least moderate anxiety sensitivty (Allan et al., 2014). Cronbach's alphas ranged from .87–.96 for total and subscale items.

Data Analytic Procedures

Inferential statistics were used to examine differences between smokers with and without CVD. Welch-Satterthwaite degrees of freedom were used in analyses where non-homogeneous variances were observed. Cohen's *d* and odds ratios were computed to index standardized effect sizes.

Results

The presence of CVD was 10.7% (n = 66). The majority of participants with CVD had only one indictor (74.2%), with an average of 1.3 (range 1–4). Differences in demographic, smoking, and health factors by CVD group is presented in Table 1. Smokers with CVD (relative to those without) had significantly higher levels of tobacco dependence, smoked longer, and were more likely to have high cholesterol, high triglycerides and diabetes.

The percentage of those that screened positive for a psychiatric disorder is presented in Table 2. Smokers with CVD, relative to those without, were significantly more likely to have major depression, panic attacks, other (generalized) anxiety, and alcohol abuse, but were not significantly more likely to have an eating disorder. See Table 2 and Figure 1 for ASI-3 results. The shared variance between ASI-3 and having any PHQ diagnoses was 18.5%. Scores on the ASI-3 were significantly higher among smokers with CVD, compared to smokers without. Smokers with CVD were significantly more likely to have moderate or high anxiety sensitivity (66.7%) relative to those without CVD (49.4%). The ASI-3 Physical

and Social concerns subscales had the largest sized effects. An examination of item-level data (see Table 3) indicated that three items from the Physical concerns subscale (#3, 8, 12) had the largest differences by CVD status. These items reflect specific concern about cardiac related symptoms. Additionally, three items from the Cognitive concerns subscale (#6, 9, 13) demonstrated the largest differences by CVD status. These items reflect fear/worry that others will notice anxiety sensations.

Discussion

Anxiety sensitivity was significantly higher among smokers with CVD relative to those without (medium-sized differences): 66.7% of those with CVD had high anxiety sensitivity relative to 49.4% in those without CVD. Items on the ASI-3 reflecting concern about physical consequences of cardiac-related anxiety sensations may be uniquely prominent among individuals with CVD. Individuals with CVD, relative to those without, also had higher average scores on items reflecting concerns about the social consequences of experiencing somatic sensations. Such concerns may drive avoidance of certain health behaviors due to embarrassment (e.g., exercising in public; Clark et al., 2013).

Generalized anxiety/worry is linked to adaptive health behaviors (Meyer, Hussein, Lange, & Herrmann-Lingen, 2015; Parker, Hyett, Hadzi-Pavlovic, Brotchie, & Walsh, 2011), potentially due to increase vigilance to health which may prompt individuals to seek medical care. However, excessive worry and fear of bodily sensations (including cardiac sensations) and the formulation of inaccurate assumptions about the meaning of such sensations may increase subjective cardiac pain/symptoms (Zvolensky et al., 2003) which may lead to maladaptive responses (e.g., non-attendance/compliance with cardiac rehabilitation due to uncomfortable bodily sensations elicited why exercising). Simply being aware of bodily sensations is not the same as catastrophically interpreting the sensations. More work is needed to understand the nuances of awareness, cognitive interpretation/ misappraisal, and behavioral responses to bodily sensations among individuals with CVD.

There are several limitations to the current study. First, CVD was determined by self-reported presence of one of six indicators, thus was a crude assessment of CVD presence that does not capture severity of CVD. The results require replication in clinical samples of individuals with diagnosed CVD, and also take into account heterogeneity in CVD. Second, the pattern of results is likely not be unique to cigarette smokers and should be explored in other more representative sample of individuals with CVD. Third, all data were self-reported and collected via an online platform. Lastly, the sample was primarily white, well-educated, and had fairly high annual household income, thus the generalizability of these findings to more heterogeneous samples may be limited.

The tendency to be fearful of bodily sensations (anxiety sensitivity) appears to be prominent in individual with CVD and may therefore be an important target for treatment. Facilitating decreased emotional reactivity (i.e., fear) and increase adaptive responding to bodily sensations (Smits et al., 2008) could decrease subjective cardiac symptom severity and promote health protective behaviors (e.g., physical activity) for CVD patients.

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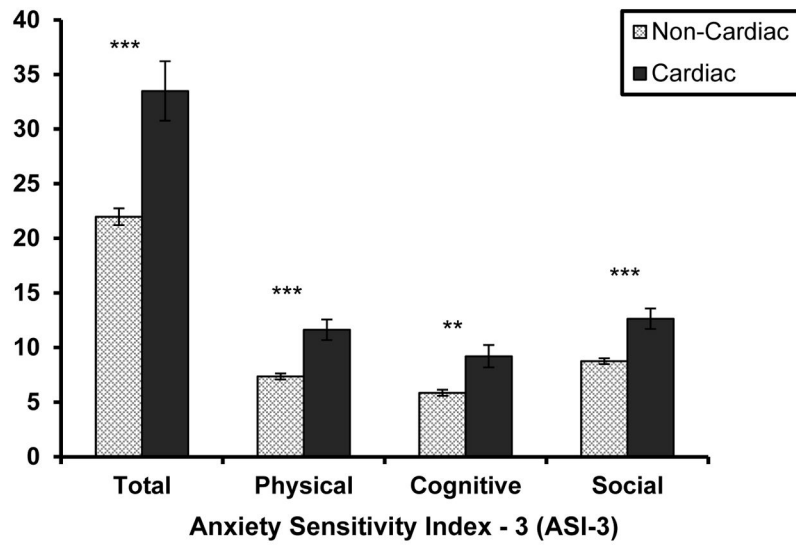
Figure 1.
Anxiety Sensitivity Index-3 (ASI-3) by smokers with and without CVD indicators

Table 1

Demographic, health, and psychiatric characteristics among smokers with and without a history of CVD

Variable	Total (n = 619)	CVD (n = 66)	Non-CVD (n = 553)	$t_{(df)}$ or x^2
Demographics				
Gender (female)	315 (50.9%)	35 (53.0%)	280 (50.6%)	.14
Age	44.0 (13.66)	47.2 (13.48)	43.6 (13.65)	$-2.01_{(617)}$ *
Race (non-white)	68 (11.0%)	4 (6.1%)	64 (11.6%)	1.83
Ethnicity (Hispanic)	46 (7.4%)	7 (10.6%)	39 (7.1%)	1.08
Marital Status (married)	319 (51.5%)	36 (54.5%)	283 (51.2%)	.27
Education (part college)	446 (72.1%)	46 (69.7%)	400 (72.3%)	.20
Employment (full time)	318 (51.4%)	24 (36.4%)	294 (53.2%)	6.66 **
Income ($50,000)	215 (40.1%)	19 (33.9%)	196 (40.8%)	.99
Smoking Characteristics				
Years smoking	25.4 (14.25)	29.1 (15.09)	25.0 (14.09)	$-2.25_{(617)}$ *
Cigarettes/day (past week)	17.0 (8.31)	18.3 (9.45)	16.8 (8.16)	-1.44
Tobacco Dependence (FTND)	5.4 (1.97)	6.1 (1.75)	5.3 (1.98)	$-3.72_{(86.1)}$ ***
Health Risk Indicators				
Body Mass Index	27.9 (7.34)	27.8 (7.24)	27.9 (7.36)	$.13_{(587)}$
High Cholesterol (Yes)	113 (18.3%)	21 (31.8%)	92 (16.6%)	9.11 **
High Triglycerides (Yes)	108 (17.4%)	21 (31.8%)	87 (15.7%)	10.59 **
Diabetes (Yes)	57 (9.2%)	13 (19.7%)	44 (8.0%)	9.72 **
MVPA (minutes/wk)	251.3 (448.56)	215.5 (345.20)	255.5 (459.41)	0.69
Sedentary time (hours)	7.9 (4.31)	8.2 (4.64)	7.9 (4.37)	-0.62
PHQ Diagnosis n(%)				
Major Depression	79 (12.8%)	22 (33.3%)	57 (10.3%)	28.08 ***
Panic Attack	87 (14.1%)	16 (24.2%)	71 (12.8%)	6.35 *
Other Anxiety	69 (11.1%)	17 (25.8%)	52 (9.4%)	15.92 ***
Eating Disorder	29 (4.7%)	5 (7.6%)	24 (4.3%)	1.38
Alcohol Abuse	107 (17.3%)	21 (31.8%)	86 (15.6%)	10.91 **

*
$p < .05$,

**
$p < .01$,

***
$p < .001$; df in parenthesis;

CVD = Cardiovascular disease; MVPA = Moderate-to-vigorous physical activity

Table 2

ASI-3 and Psychiatric Disorders by CVD status

Dimensional $_{M(SD)}$	Total (n = 619)	CVD (n = 66)	Non-CVD (n = 553)	$t_{(df)}$	d
ASI-3 Total	23.2 (18.73)	33.5 (22.15)	22.0 (17.92)	$-4.07_{(75.5)}$ ***	0.57
ASI-3 Physical	7.8 (6.82)	11.6 (7.69)	7.4 (6.57)	$-4.34_{(76.8)}$ ***	0.59
ASI-3 Cognitive	6.2 (6.91)	9.2 (8.34)	5.9 (6.64)	$-3.15_{(75.2)}$ **	0.44
ASI-3 Social	9.2 (6.55)	12.7 (7.62)	8.8 (6.29)	$-3.99_{(76.0)}$ ***	0.56
Categorical $_{n(\%)}$	**ASI-3 $_{M(SD)}$**	**Total (n = 619)**	**CVD (n = 66)**	**Non-CVD (n = 553)**	**x^2**
Moderate-High AS (17)	38.1 (14.46)	317 (51.2%)	44 (66.7%)	273 (49.4%)	7.06 **
'Normative' AS (<17)	7.6 (4.70)	302 (48.8%)	22 (33.3%)	280 (50.6%)	

*
$p<.05$,

**
$p<.01$,

***
$p<.001$

Table 3

Anxiety Sensitivity Index-3 (ASI-3) item averages by CVD status

	CVD		Non-CVD		Cohen's *d*
Anxiety Sensitivity Index-3 (ASI-3)	*M*	*SD*	*M*	*SD*	
Physical Subscale					
3. It scares me when my heart beats rapidly.	2.5	1.43	1.7	1.32	**0.58**
4. When my stomach is upset, I worry that I might be seriously ill.	1.4	1.45	0.9	1.21	0.37
7. When my chest feels tight, I get scared that I won't be able to breathe properly.	2.1	1.59	1.5	1.40	0.40
8. When I feel pain in my chest, I worry that I'm going to have a heart attack.	2.4	1.47	1.4	1.39	**0.70**
12. When I notice my heart skipping a beat, I worry that there is something seriously wrong with me.	1.8	1.38	1.1	1.36	**0.51**
15. When my throat feels tight, I worry that I could choke to death.	1.4	1.68	0.7	1.17	0.48
Cognitive Subscale					
2. When I cannot keep my mind on a task, I worry that I might be going crazy.	1.5	1.53	1.0	1.32	0.35
5. It scares me when I am unable to keep my mind on a task.	1.8	1.51	1.2	1.30	0.43
10. When I feel "spacey" or spaced out I worry that I may be mentally ill.	1.3	1.53	0.8	1.24	0.36
14. When my thoughts seem to speed up, I worry that I might be going crazy.	1.4	1.57	0.9	1.28	0.35
16. When I have trouble thinking clearly, I worry that there is something wrong with me.	1.6	1.47	1.0	1.25	0.44
18. When my mind goes blank, I worry there is something terribly wrong with me.	1.5	1.50	0.9	1.25	0.43
Social Subscale					
1. It is important for me not to appear nervous.	2.7	1.25	2.3	1.26	0.32
6. When I tremble in the presence of others, I fear what people will think of me	2.0	1.46	1.2	1.38	**0.56**
9. I worry that other people will notice my anxiety.	2.1	1.70	1.3	1.42	**0.51**
11. It scares me when I blush in front of people.	1.4	1.55	0.8	1.20	0.43
13. When I begin to sweat in a social situation, I fear people will think negatively of me.	2.0	1.56	1.2	1.37	**0.54**
17. I think it would be horrible for me to faint in public.	2.6	1.53	1.9	1.53	0.46

Note: All means are statistically significant. Effect sizes   .5 reflecting medium size effects are in bold.