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Associations between emotional symptoms and self-reported aberrant driving behaviors in older adults

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ABSTRACT

Objective: To examine associations between internalizing symptoms and self-reported aberrant driving behaviors in a large sample (n = 341) of older adults (mean age = 62.6 years, SD = 4.8).
Design: Cross-sectional survey.
Results: Multiple regression analyses revealed that greater symptoms of emotional distress (i.e., higher scores on the Expanded Version of the Inventory of Depression and Anxiety Symptoms (IDAS-II) emotional distress composite) were associated with greater aberrant driving behaviors (i.e., higher scores on the Driving Behavior Questionnaire). In contrast, neither obsessions/fears nor emotional well-being were associated with greater aberrant driving behaviors. Follow-up regression analyses examining specific IDAS-II subscales revealed that greater suicidality, appetite gain, appetite loss, panic, and ill temper were associated with greater aberrant driving behaviors. Individuals reporting greater suicidality and appetite loss reported greater tendencies to unintentionally commit errors behind the wheel, while individuals reporting greater ill temper and appetite loss reported greater tendencies to intentionally engage in unsafe driving behaviors that may put other drivers in harm's way.
Conclusion: Older adults reporting emotional distress may be at risk for engaging in aberrant driving behaviors. In particular, certain symptoms of emotional distress (e.g., suicidality, ill temper) are tied to higher rates of aberrant driving behaviors within this population.

1. Introduction

Cognitive abilities have been explored in great depth as a predictor of ability to complete everyday tasks including driving (Anstey et al., 2005; Salvucci et al., 2001). More recently, mood has also emerged as a potential contributor to the basis for safe driving. While most work suggests emotional symptoms themselves do not cause crashes, they are thought to impede cognitive capacities (e.g., attention, working memory) necessary for driving, and thus play an indirect role in increasing crash risk (Jeon et al., 2014; Shahar, 2009).

Emotions are not always consistent across a driving session and may change considerably throughout a driving session depending on factors inherent to the drive (Mesken et al., 2007) or incidental events such as the type of music on the radio or images on the billboards (Trick et al., 2012; van der Zwaag et al., 2012). As a result, previous work has sought to examine how in-the-moment (i.e., state-level) emotional symptoms experienced while driving, such as anger, impact overall driving safety (Grimm et al., 2007; Rebolledo-Mendez et al., 2014), including increased tendency to speed (Rhodes et al., 2015) and attitudes toward engaging in potentially dangerous driving behaviors (Hu et al., 2013). In addition to anger, other state-level emotional symptoms, including fear and anxiety, have also been shown to have an effect on completion of various tasks including driving (Taylor et al., 2008). Numerous factors help determine whether the effects of these symptoms are positive or negative on performance (Eysenck and Calvo, 1992; Taylor et al., 2008). Schmidt-Daffy (2013) proposed that whereas drivers experience fear when the task demands exceed their perceived capabilities (i.e., lower visibility of the road), they experience anxiety when there is a conflict between their goals of safety and velocity (i.e., being incentivized to both drive safely and quickly) (Schmidt-Daffy, 2013). Others have found that while both individuals of high and low state-level anxiety performed worse on a driving simulator task as anxiety threat conditions increased, those who reported high anxiety showed greater drops in performance relative to low anxiety individuals, consistent with the processing efficiency theory (Wilson et al., 2006).

In an effort to explore possible risk factors for dangerous driving and crash risk, recent work has begun to evaluate how internalizing symptoms experienced in daily life, rather than state mood or anxiety at

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the time of driving, may be related to driving performance. Anxiety symptoms in particular have been broadly linked to self-reported driving ability such that individuals who reported more aberrant driving behaviors also reported greater anxiety (Pourabdian and Azmoon, 2013; Shahar, 2009). Higher anxiety has also been linked to greater crash risk and increased likelihood of driving under the influence of alcohol (Dula et al., 2010). Individuals with greater lifetime history of stress have also been identified as at greater risk for engaging in anxious driving behaviors (e.g., exaggerated safety, aggressive behaviors while driving) following a crash (Clapp et al., 2011). However, others have failed to identify a deleterious effect of anxiety symptoms on self-reported risky driving behaviors (Vassallo et al., 2008). Importantly, these studies assess anxiety using total scores from measures such as the Beck Anxiety Inventory (BAI) (Beck et al., 1988) or the State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1970). These measures are limited in that the total scores derived from these measures do not capture the full heterogeneity of anxiety-related symptoms that individuals may present with, and these measures also fail to assess specific anxiety-related disorders (e.g., PTSD, panic disorder, social anxiety disorder) (Bados et al., 2010; Watson and Stanton, 2017). Anxiety-related disorders are both rooted in individual anxiety symptom clusters (e.g., panic disorder and somatic symptoms) (Hoehn-Saric et al., 2004; Kendall-Tackett, 2000) and have also been linked to poorer driving performance. For example, individuals with PTSD have shown higher likelihood of speeding and more problems with adjustment-to-stimuli (Classen et al., 2011). Collectively, these findings indicate that a study examining a greater diversity of anxiety-related symptoms in drivers is necessary to determine which specific aspects of anxiety are most related to driving behaviors (Taylor et al., 2000).

In comparison to the anxiety literature, the association between symptoms of depression and driving has not been as commonly explored. What research does exist in this area remains inconclusive; whereas some have identified an association between depressive symptoms and both poorer driving ability and increased risk of motor vehicle crash (Bulmash et al., 2006; Hilton et al., 2009; Selzer et al., 1968; Shen et al., 2009; Wingen et al., 2006), others have failed to denote any relationship (Ramaekers et al., 1997). Inconsistencies in findings related to depression and driving may be partially attributable to the fact that depression may be expressed via a host of different symptoms (e.g., poor concentration, change in appetite) (Fried and Nesse, 2015). Additionally, while a number of prior studies examining anxiety-driving relationships have measured anxiety symptoms continuously (Pourabdian and Azmoon, 2013; Shahar, 2009), past work examining depression-driving relationships have done so exclusively via case-control designs (i.e., clinically depressed individuals versus healthy comparisons). Given recent evidence in support of measuring psychopathology via continuous as opposed to categorical methods, it appears necessary to explore whether continuously-measured depressive symptoms may be associated with self-reported driving behaviors (Markon et al., 2011). Utilizing continuous data to assess a variety of depression symptom domains would allow for a more nuanced evaluation of the relationship between depressive symptoms and driving behaviors.

Despite recent studies examining associations between both state-level anxiety and internalizing symptoms experienced in daily life with driving behaviors, these have largely been limited to young adult samples (Dula et al., 2010; Pourabdian and Azmoon, 2013; Shahar, 2009). Older adults have been less of a focus in the literature; this is surprising given that a sizeable portion of older adults (17–20%) report experiencing anxiety while driving (Taylor et al., 2010). As many as 20% of older adults who no longer drive report "increased nervousness behind the wheel" as their main reason for doing so, second only to "advice from doctor" (27%) (Persson, 1993). Additionally, with the exception of Taylor et al. (2010) examination of anxiety symptoms, no studies have explored whether other everyday emotional symptoms (e.g., fear, depression) are associated with driving behaviors in older adults, leaving questions as to whether other emotional symptoms may be partially responsible for the high crash risk and self-reported driving difficulties often observed in older adults (Ball et al., 2006; Preusser et al., 1998; Ryan et al., 1998). Exploration of this topic would allow clinicians to identify older adults who, based on their present emotional functioning, may require an evaluation as to whether they should continue to drive or abstain from doing so until certain emotional symptoms have been treated or have dissipated.

Overall, a more thorough examination of associations between emotional symptoms and driving behaviors in older adults appears warranted. In particular, recent work suggests that conceptualizing emotional functioning as constituting a hierarchical structure of internalizing symptoms may provide greater information regarding global functioning than diagnoses (Waszczuk et al., 2017). Overreliance on global scores from measures assessing anxiety and depression (e.g., anxiety: the BAI, the STAI) may also limit the capacity to explore emotion-driving relationships in greater depth. Thus, an examination of the contributions of a variety of everyday internalizing symptoms to driving behaviors among older adults appears warranted.

1.1. Hypotheses

Given prior literature on the associations between anxiety-related symptoms and driving behaviors in younger adults as well as evidence of a possible role of anxiety-related symptoms in driving cessation in older adults (Dula et al., 2010; Pourabdian and Azmoon, 2013; Shahar, 2009; Taylor et al., 2010), it is hypothesized that individuals who report greater symptoms broadly related to emotional distress and to fear and obsessions will report greater aberrant driving behaviors. Additionally, given the dearth of significant findings related to positive mood and driving behaviors in this population, it is also hypothesized that emotional symptoms related to positive mood will not be related to self-reported driving behaviors.

2. Material & methods

2.1. Procedure

This study was approved by the Louisiana State University Institutional Review Board. Participants responded to an advertisement posted on Amazon Mechanical Turk (MTurk), a popular website in which research participants complete surveys and tasks online in exchange for nominal compensation. MTurk participants represent a diverse set of racial, educational and financial backgrounds, and have been identified as consistent with the general population and more diverse than other convenience samples (e.g., college students) (Buhrmester et al., 2011). Data collected via MTurk has been of high quality across studies. Further, to ensure the high quality of the data collected for this study, four validity check questions were included in the survey (e.g., "If you are reading this, select most of the time"). Individuals who failed any validity check question were excluded from analysis (n = 4).

Data collected for the present study were part of a larger survey that included questionnaires related to emotional symptoms, driving behaviors, and self-reported cognitive functioning. The advertisement indicated the opportunity to participate in a survey examining emotional symptoms and every day cognition. The survey link was only visible to participants who met initial inclusion criteria, which included that participants be 55 years of age or older, native English speakers, U.S. residents and have satisfactorily completed at least 95% of their previous MTurk assignments. Exclusion criteria included history of a traumatic brain injury or a stroke within the past year or history of psychosis. Individuals were also excluded if they reported not currently being an active driver or reported driving zero miles on average each week. In total, 386 participants were given the health screener for possible inclusion in the current study. Participants interested in

completing the survey were directed to click on a link that sent them to a secure online data collection webpage. Participants who were not invited to complete the survey were instructed to close the screener window and return to the MTurk website.

Participants who were invited to complete the survey were directed to an online consent form and the survey. Upon completion of the survey, participants were given a unique code to enter into the MTurk system to receive compensation for survey completion. Participants were compensated $1.50 for completing the 45-minute survey, which is above average pay for work of that length on MTurk.

2.2. Participants

Of the 386 individuals who completed the health screener, a total of 341 participants met inclusion criteria and provided valid data and were thus included in analyses. Participants had a mean of 62.6 years of age (SD = 4.8, median = 62, minimum = 55, maximum = 80, range = 25). A total of 10.6% reported having a high school diploma, 32.3% reported some college education, 37.0% reported a four-year college degree, 15.0% held a master's degree, and 4.2% held a doctorate. The sample was predominantly female (66.6%), Caucasian (86.1%), and not of Hispanic or Latino ethnicity (97.8%). Participants reported driving a mean of 94.9 miles (SD = 105.4) per week.

2.3. Measures

2.3.1. Driving behaviors assessment

The original version of the Driving Behavior Questionnaire (DBQ) was used to assess frequency of participants' aberrant driving behaviors (Reason et al., 1990). This version of the DBQ is a 16-item paper-and-pencil self-report measure assessing two subscales measuring: (1) Errors (i.e., unintentional behaviors that could affect safety of other drivers on the road, such as getting into the wrong lane when approaching an intersection), and (2) Violations (i.e., intentionally breaking safe driving rules that likely affect the safety of other drivers, such as getting involved in unofficial 'races' with other drivers). Higher scores on the DBQ indicate greater frequency of engaging in aberrant driving behaviors (i.e., on a scale of 1 (Never) to 6 (Nearly All The Time)). The mode of administration of the questionnaire was modified to allow for online completion.

2.3.2. Internalizing symptoms assessment

The Expanded Version of the Inventory of Depression and Anxiety Symptoms (IDAS-II) was used to measure emotional symptoms (Watson et al., 2012). This version of the IDAS-II includes 18 symptom scales related to DSM-IV mood and anxiety disorders. Prior work found evidence for a three-factor structure of these 18 scales in adults: emotional distress, fear/obsessions, and positive mood (Watson et al., 2012). The emotional distress scale includes factor loadings from subscales related to dysphoria, lassitude, ill temper, panic, traumatic intrusions, insomnia, appetite loss, mania, suicidality, traumatic avoidance and appetite gain. The fears/obsessions scale includes factor loadings from subscales related to cleaning, ordering, checking, claustrophobia and social anxiety. The positive mood scale includes factor loadings from subscales related to euphoria and well-being. Respondents report the extent to which they have experienced each symptom during the past two weeks on a scale of 1 (Not at All) to 5 (Extremely). Composites are computed by summing subscale raw scores that load onto each composite and dividing by the number of subscales included in that composite. The IDAS-II has been shown to have strong convergent and discriminant validity (Watson et al., 2007, 2012).

2.4. Analyses

SPSS Version 25 was used for all statistical analyses and statistical significance was set at $p < .05$. Hierarchical multiple regression analyses were used to assess: (1) associations between emotional distress and driving behaviors, (2) associations between fear and obsessions and driving behaviors, and (3) associations between positive mood and driving behaviors. In order to assess these relationships, a total of three separate regressions were performed; one with each of the two DBQ subscales (i.e., Errors and Violations) as the dependent variable, as well as one with the DBQ total score as the dependent variable. Demographic variables (i.e., age, gender) were included in step 1 as these factors have proven related to driving behaviors among cognitively healthy older adults (Schwebel et al., 2007), Emotional distress, fear/obsessions, and positive mood were entered simultaneously in step 2 to examine contributions of each to self-reported driving behaviors.

For any of the three IDAS-II composites that emerged as a significant predictor of any outcome variables, follow-up simultaneous multiple regression analyses were used to examine specific emotional symptoms (i.e., individual IDAS-II subscales) that were associated with outcome variables.

3. Results

Correlations between DBQ scores, IDAS-II composites and IDAS-II subscales may be found in Table 1. The two DBQ subscales and DBQ total score were all weakly to moderately correlated with both the IDAS-II Distress and Obsessions/Fears composites (r ranges: $r = .27$ to $r = .32$, $p < .05$). Neither of the DBQ subscales nor DBQ total score was associated with the IDAS-II Well-Being composite (r ranges: $-.01$ to $-.03$, $p > .05$). Both DBQ subscales and DBQ total score were weakly to moderately correlated with scores on all IDAS-II subscales (r ranges: $r = .12$ to $r = .41$, $p < .05$) with the exception of Well-Being (r ranges: $r = -.09$ to $r = -.11$, $p > .05$).

Results of hierarchical regression analyses with IDAS-II composites as predictor variables may be found in Table 2. Higher scores on the IDAS-II Distress composite were associated with higher scores on both the DBQ Errors (B = .35, t (286) = 3.99, $p < .001$) and Violations (B = .29, t (286) = 2.95, $p < .01$) subscales, overall model $F(3, 281) = 11.90$, adjusted $R^2 = .16$, and overall model $F(3, 281) = 9.44$, adjusted $R^2 = .13$, respectively. Higher scores on the IDAS-II Distress composite also were associated with higher total DBQ scores, $F(5, 281) = 13.92$, adjusted $R^2 = .18$, B = .63, t (286) = 3.98, $p < .001$. Neither the IDAS-II Obsessions/Fears composite nor the IDAS-II Well-Being composite were associated with any DBQ scores, all $p > .05$.

Given associations between IDAS-II Distress composite scores and DBQ Errors scores, a regression was conducted examining associations between individual IDAS-II Distress subscales and DBQ Errors scores. Results of hierarchical regression analyses with IDAS-II Distress subscales as predictors may be found in Table 3. Several Distress-associated subscales were associated with DBQ Errors scores, $F(11, 274) = 5.91$, adjusted $R^2 = .18$, $p < .001$. Specifically, higher scores on the IDAS-II Suicidality subscale, B = .33, t (286) = 3.14, $p < .01$, and higher scores on the IDAS-II Appetite Loss subscale, B = .15, t (286) = 2.06, $p < .05$, both were associated with higher scores on the DBQ Errors subscale.

Given associations between IDAS-II Distress composite scores and DBQ Violations scores, a regression was conducted examining associations between individual IDAS-II Distress subscales and DBQ Violations scores. Several Distress-associated subscales were associated with DBQ Violations scores, $F(11, 274) = 5.15$, adjusted $R^2 = .16$, $p < .001$. Specifically, higher scores on the IDAS-II Ill Temper subscale, B = .26, t (286) = 2.74, $p < .05$, and higher scores on the Appetite Loss subscale, B = .22, t (286) = 2.72, $p < .01$, were associated with higher scores on the DBQ Violations subscale.

Given associations between IDAS-II Distress composite scores and DBQ Total scores, a regression was conducted examining associations between individual IDAS-II Distress subscales and DBQ Total scores. Several IDAS-II subscales were associated with total DBQ scores, $F(11, 274) = 7.32$, adjusted $R^2 = .22$, $p < .001$. In particular, higher scores

Table 1
Correlations Among DBQ Scores, IDAS-II Composite and IDAS-II Subscales.

Variable	1	2	3	4	5	6
1. DBQ Errors	–					
2. DBQ Violations	.58**	–				
3. DBQ Total	.88**	.90**	–			
4. IDAS-II Distress composite	.31**	.27**	.32**	–		
5. IDAS-II Obsessions/Fears composite	.29**	.28**	.32**	.68**	–	
6. IDAS-II Well-Being composite	−.01	−.03	−.02	−.36**	−.02	–
7. IDAS-II Dysphoria	.28**	.23**	.29**	.90**	.55**	−.48**
8. IDAS-II Lassitude	.21**	.17**	.21**	.77**	.39**	−.34**
9. IDAS-II Insomnia	.13*	.12*	.14*	.71**	.46**	−.22**
10. IDAS-II Suicidality	.37**	.29**	.37**	.68**	.51**	−.21**
11. IDAS-II Appetite Loss	.15**	.15**	.17**	.56**	.30**	−.16**
12. IDAS-II Appetite Gain	.20**	.13*	.18**	.45**	.28**	−.15**
13. IDAS-II Well-Being	−.09	−.10	−.11	−.46**	−.14**	.96**
14. IDAS-II Temper	.27**	.27**	.30**	.69**	.46**	−.23**
15. IDAS-II Mania	.29**	.27**	.31**	.70**	.68**	−.03
16. IDAS-II Euphoria	.20**	.18**	.21**	.07	.31**	.67**
17. IDAS-II Panic	.21**	.18**	.22**	.75**	.54**	−.18**
18.IDAS-II Social Anxiety	.41**	.28**	.38**	.64**	.66**	−.16**
19. IDAS-II Claustrophobia	.19**	.16**	.20**	.55**	.78**	−.08
20. IDAS-II Traumatic Intrusions	.23**	.19**	.24**	.76**	.52**	−.35**
21. IDAS-II Traumatic Avoidance	.17**	.16**	.18**	.64**	.61**	−.12*
22. IDAS-II Checking	.20**	.22**	.24**	.62**	.82**	−.08
23. IDAS-II Ordering	.20**	.23**	.23**	.39**	.75**	.11
24. IDAS-II Cleaning	.15**	.18**	.19**	.48**	.83**	.05
25. IDAS-II Anxious Mood	.20**	.15**	.20**	.80**	.51**	−.44**
Mean	9.99	10.49	20.47	7.99	7.11	15.66
Standard Deviation	2.45	2.66	4.54	2.45	2.53	4.56
Range	8–22	8–23	16–45	5.36–17.91	5.20–19.60	6.50–28.00

Note: DBQ = Driving Behavior Questionnaire; IDAS-II = Inventory of Depression and Anxiety Symptoms-Expanded Form.
* Indicates significance at the p < .05 level.
** Indicates significance at the p < .01 level.

on the IDAS-II Suicidality subscale, B = .52, t (286) = 2.74, p < .01, the Appetite Loss subscale, B = .37, t (286) = 2.81, p < .01), the Appetite Gain subscale, B = .21, t (286) = 2.03, p < .05, the Panic subscale, B = −.22, t (286) = −1.99, p < .05, and the Ill Temper subscale, B = .34, t (286) = 2.05, p < .05, were all associated with higher DBQ Total scores. No other Distress-associated IDAS-II subscales were associated with either DBQ subscale or DBQ Total scores.

4. Discussion

The current study examined the relationships between self-reported emotion and subjective driving performance in older adults, which is a limited, but emerging field of study in the driving literature (Parr et al., 2016). The hypothesis that greater emotional distress and reported fears and obsessions would be related to greater aberrant driving behaviors was partially supported. Relationships were observed between self-reported driving behaviors and all IDAS-II subscales with the exception of the well-being subscale. Further, the IDAS-II Distress composite, which consists of items that commonly measure the cognitive, affective, and somatic symptoms commonly present in disorders such as anxiety, depression and PTSD, was associated with greater aberrant driving behaviors. In contrast, the Fears and Obsessions composite, which consists of items consistent with symptoms of fear/anxiety, phobia, and obsessive-compulsive disorder, was not associated with greater aberrant driving behaviors. These results are consistent with previous findings that found relationships between anxiety (Dula et al., 2010; Shahar, 2009), anxiety-related disorders (e.g., PTSD) (Clapp et al., 2011), and depression (Bulmash et al., 2006) with self-reported driving behaviors, although others have failed to find these relationships (Ramaekers et al., 1997; Vassallo et al., 2008). Trait repetitive negative thinking (e.g., rumination, worry, thought intrusions) is common amongst these disorders and has been shown to redirect attention and cognitive resources that are needed for driving to alternative stimuli. Further, anxiety has been found to have a differential impact on performance that is dependent on anxiety severity (Yerkes and Dodson, 1908). Therefore, optimal levels of anxiety may enhance driving performance, while low or high levels of anxiety are potentially detrimental to driving performance (Taylor et al., 2008).

Table 2
Analysis of the Effects of Emotional Symptom Composites on Driving Behavior.

	DBQ Errors			DBQ Violations			DBQ Total		
Variables	β	Adj. R^2	R^2 Δ	β	Adj. R^2	R^2 Δ	β	Adj. R^2	R^2 Δ
Step 1		.02*			.02**			.03**	
Age	.07			.02			.05		
Gender	−.13*			−.17**			−.18**		
Step 2		.16**	.15**		.13**	.11**		.18**	.17**
Distress	.35**			.27**			.35**		
Obsessions/Fears	.08			.11			.11		
Well-Being	.15*			.07			.12		

* Indicates significance at the p < .05 level.
** Indicates significance at the p < .01 level.

Table 3
Analysis of the Effects of Distress Composite Symptom Subscales on Driving Behavior.

	DBQ Errors			DBQ Violations			DBQ Total		
Variables	β	Adj. R^2	R^2 Δ	β	Adj. R^2	R^2 Δ	β	Adj. R^2	R^2 Δ
Step 1		.02*			.02*			.03*	
Age	.07			.02			.05		
Gender	−.14*			−.18**			−.18**		
Step 2		.18**	.20**		.16**	.17**		.22**	.23**
Dysphoria	−.07			−.12			−.11		
Lassitude	.13			.07			.11		
Ill-Temper	.08			.21*			.17*		
Panic	−.13			−.15			−.16*		
Trauma-Intrusions	−.01			.02			.01		
Trauma-Avoidance	−01			.02			.01		
Insomnia	−.05			−.01			−.03		
Appetite Loss	.14*			.18**			.18**		
Appetite Gain	.12			.11			.13*		
Mania	.15			.11			.15		
Suicidality	.26**			.14			.22**		

* Indicates significance at the $p < .05$ level.
** Indicates significance at the $p < .01$ level.

With respect to the effects of the Fears and Obsessions composite on driving behaviors, the literature provides mixed findings which may be explained by avoidant and obsessive behaviors in these groups (Barnard and Chapman, 2016; Taylor et al., 2010). Previous studies have found that older individuals with agoraphobia, social phobia, and driving-related anxiety and fear have been shown to drive less frequently, use alternative modes of transportation (e.g., public transportation, walking, receiving transport from family and friends) more frequently, and drive during "less risky" periods (e.g., avoid rush hour traffic) than their healthy age-matched peers (Ehlers et al., 1994; Taylor et al., 2010). Thus, the tendency for these individuals to avoid what they fear (e.g., driving) may affect the rates of driving errors and violations in these individuals, which may obscure the relationship (Taylor et al., 2010). Additionally, these findings may be further explained by the content of the subscales that comprise the fears/obsessions composite, as the fears/obsessions composite assess for certain behaviors (e.g., checking, ordering) that may be indicative of good driving (e.g., performing driving behaviors in sequential order or checking mirrors before switching lanes).

Similar to findings related to the Fears and Obsessions composite, the Well-Being composite also did not demonstrate an effect on driving behaviors. This finding is consistent with hypotheses and suggests that positive affect is not associated with driving behaviors, either positively or negatively. While some work has shown that mobility is associated with well-being in older adults (Carp, 1988), the present study's use of the IDAS-II allowed for an examination of the effects of solely well-being on driving behaviors, excluding other related variables (e.g., depressive symptoms).

The Distress composite was associated with greater overall aberrant driving behaviors as well as increased driving errors (i.e., unintentional potentially dangerous driving behaviors) and violations (i.e., intentional dangerous driving). These results support previous findings that suggest increased emotional distress and poor emotion regulation are risk factors for poorer self-reported driving (Hancock et al., 2012; Mesken et al., 2007; Scott-Parker et al., 2013). While symptoms of emotional distress themselves do not directly affect driving performance, emotional distress may redirect attentional and cognitive resources needed for driving to alternative stimuli (e.g., roadway signs) or thoughts (e.g., rumination, worry) (Lemercier et al., 2014; Suhr and Dula, 2017; Taylor et al., 2008; Wilson et al., 2006) and disrupt decision-making abilities needed for driving (Chan and Singhal, 2013). Further, psychomotor disturbance experienced by those in emotional distress has also been found to impact driving performance (Bulmash et al., 2006).

A more in-depth analysis of the distress composite subscales revealed that higher rates of self-reported suicidality were also associated with poorer self-reported overall driving as well as driving errors. Individuals at risk for suicide are more likely to engage in ruminative processes (e.g., reflection, brooding) than depressed individuals and healthy controls (Miranda and Nolen-Hoeksema, 2007), which likely directs attention to negatively-valenced thoughts and stimuli and away from driving-related stimuli.

Individuals who scored higher on the Ill-Temper subscale reported more driving violations as well as poorer overall driving performance. Affective lability has been linked to increased impulsive, aggressive, and risky behaviors (Dvorak et al., 2013). In line with these findings, individuals who frequently demonstrate "driving anger" have been found to more frequently engage in risky and aggressive driving behaviors and are more likely to be involved in motor vehicle crashes (Dahlen and White, 2006).

The panic subscale was also related to worse self-reported overall driving. Individuals with anxiety disorders such as panic disorder have been found to make more driving errors compae panic disorder demonstrate increased attention bias towards physical threat cues (e.g., potential for motor vehicle crashes) (Asmundson et al., 1992) as well as towards internal physical sensations (e.g., heart palpitations, sweating) (Schmidt et al., 1997). Thus, individuals who experience panic or are diagnosed with panic disorder may be more likely to exhibit poorer overall driving performance because of distracted driving due to these attention biases.

The appetite gain subscale was associated with overall aberrant driving behaviors and the appetite loss subscale was associated with driving errors, violations, and overall aberrant driving behaviors. Little research on the relationship between appetite and driving behaviors has been reported, and as a result only speculations about their association may be offered in the present manuscript. Although appetite itself may not contribute to poorer self-reported driving behaviors, appetite gain is often a symptom of atypical depression (Blanco et al., 2012; Matza et al., 2003), which has been shown to affect attentional resources needed for driving (Lin et al., 2014). Appetite loss may be an indicator of various underlying affective disorders (e.g., anxiety, PTSD) that result in attention biases, processing inefficiencies, and impulsive behaviors which may lead to driving errors and violations (Watson and Stanton, 2017). Despite this work, studies exploring associations between appetite gain and loss and aberrant driving behaviors in greater depth are necessary to further elucidate these relationships.

The results from the current study provide important implications for crash prevention in emotionally distressed older adult populations

by delineating which aspects of distress are most likely to interfere with driving behavior. Further, these results highlight the potential need for clinicians to include recommendations regarding driving (e.g., need for an on-road driving examination) in individuals with severe emotional distress. However, clinicians should consider the potential impact of driving cessation on older adults when making these recommendations as changes in driving patterns have been linked to changes in psychological well-being (Anstey et al., 2006), changes in social support (Mezuk and Rebok, 2008), and depression (Fonda et al., 2001).

The present study has several strengths such as the relatively large sample size and being one of the first to examine the impact of internalizing symptoms on driving behaviors in older adults using a hierarchical and transdiagnostic approach. This approach allows for a more in-depth understanding of which aspects of psychopathology are most detrimental to driving performance (Waszczuk et al., 2017). However, despite these merits, there remain limitations. Further, an important limitation of the present study was its reliance on self-report measures. The present findings could be strengthened in future research through the use of simulated driving tasks or behavioral observations of real-world driving. Although the population of MTurk workers is considered more representative of the general population than other convenience samples, the present study did not specifically recruit a sample designed to be entirely representative of the older driver population, which limits generalizability of findings. In particular, while all participants were recruited from the United States and the gender breakdown of the current sample (66% female) is similar to the larger older adult population in the United States, the sample had a higher average educational attainment (over 50% with at least a four-year college degree) than older adults more broadly (Ryan and Bauman, 2016). Furthermore, while the older adult population continues to grow older, the current sample was composed of relatively younger older adults (i.e., average age 62) (Vincent and Velkoff, 2010). Additionally, examining the impact of broadly defined symptom clusters does not allow for an examination of the underlying variables that may be driving the relationship between emotional distress and driving performance. Future research should examine which cognitive skills mediate the relationship between emotion and driving outcomes.

While the present study examined solely internalizing symptoms, other dimensions of psychopathology (e.g., externalizing, thought dysfunction) have also been shown to contribute to driving outcomes (Selzer et al., 1968; Vassallo et al., 2008). Future studies should explore these dimensions in a single study and examine related personality traits (e.g., sensation seeking, impulsivity) (Kotov et al., 2010) and transdiagnostic mechanisms (e.g., rumination and emotional regulation) (Feldman et al., 2011; Suhr and Nesbit, 2013). This comprehensive approach would aid in determining which psychological factors are most important to target for treatment in order to improve driving behaviors and outcomes (Lemercier et al., 2014). Finally, although significant, the regression models utilized in this study accounted for only a small proportion of the total variance in DBQ scores. Thus, while the present study identified several emotional symptoms related to driving behaviors, it is worth noting that much of the variance in driving behaviors may be accounted for by factors unrelated to emotional functioning.

4.1. Conclusions

The present study supports previous research, which suggests that emotional distress can impact driving performance; however, the present study is among the first to examine this relationship in older adults using a hierarchical and transdiagnostic approach. The current study suggests that an association exists between emotional distress and both driving errors and driving violations. In particular, the IDAS-II suicidality, panic, ill-temper, as well as the appetite gain and loss subscales were found to have the strongest relationships with driving performance. These findings suggest that emotional distress and regulation deserve further attention from researchers and clinicians interested in understanding and preventing automobile-related crashes.

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