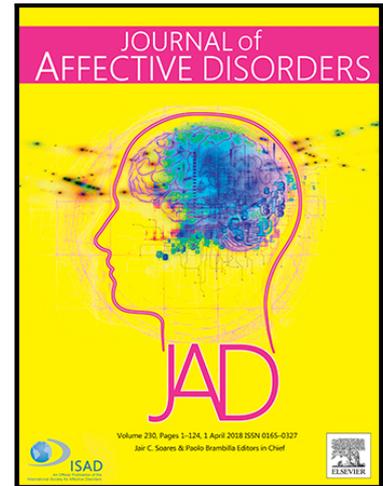


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Problematic Alcohol Use and Suicidal Ideation Among Firefighters: A Multi-Study Investigation of the Explanatory Roles of Perceived Burdensomeness and Thwarted Belongingness

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Highlights

- Problematic alcohol use appears to have an indirect effect on suicidal ideation through perceived burdensomeness in firefighters
- Problematic alcohol use may have an indirect effect on suicidal ideation through thwarted belongingness, but perhaps only among women firefighters
- Future research is needed to better determine the relationship between problematic alcohol use and suicidal ideation.

Problematic Alcohol Use and Suicidal Ideation Among Firefighters: A Multi-Study Investigation
of the Explanatory Roles of Perceived Burdensomeness and Thwarted Belongingness

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Abstract

Background: Firefighters are at increased risk for both problematic alcohol use and suicidality. Research has found that problematic alcohol use is related to suicidality among this population; however, limited data exist regarding what might account for this association. The present two-study investigation (1) examined the association between suicidality and problematic alcohol use among two large samples of current firefighters and (2) tested whether interpersonal theory of suicide constructs—perceived burdensomeness (PB) and thwarted belongingness (TB)—serve as indirect indicators of this relationship. **Methods:** Participants in Study 1 were 944 U.S. firefighters (12.5% female); participants in Study 2 were 241 U.S. women firefighters. Participants completed the Interpersonal Needs Questionnaire, Alcohol Use Disorders Identification Test, and the Depressive Symptom Index: Suicidality Subscale (Study 1) or the Self-Injurious Thoughts and Behaviors Interview (Study 2). Bias-corrected bootstrap indirect effects path analyses were utilized. **Results:** In Study 1, more problematic alcohol use was significantly associated with more severe career suicidal ideation via PB but not TB. In Study 2, problematic alcohol use was associated with career suicidal ideation via both PB and TB. PB seems to account for the relationship between problematic alcohol use and career suicidal ideation among male and female firefighters. **Limitations:** Limitations include use of a cross-sectional design, use of retrospective measures of suicidal ideation, and our findings were derived from subsamples of two existing datasets. **Conclusions:** Findings suggest that PB and TB may explain the relationship between problematic alcohol use and suicidal ideation, but that this effect is discrepant based on gender.

Keywords: firefighters, problematic alcohol use, suicidal ideation, perceived burdensomeness, thwarted belongingness

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Introduction

Suicide is a leading cause of death internationally, with over 800,000 deaths attributed to suicide annually (World Health Organization [WHO], 2014). While many factors may confer risk for suicidal thoughts (i.e., suicidal ideation) and suicidal behaviors (e.g., suicide attempts; see Franklin et al., 2017), there is evidence that certain occupational groups have different correlates and rates of suicidal thoughts and behaviors due to unique job-related hazards and exposures (Milner et al., 2013). One such group is firefighters (for a review, see Stanley et al., 2016).

Past work has shown that firefighters have higher rates of suicidal ideation relative to the general population, with one study showing that 46.8% of firefighters experience suicidal ideation and 15.5% make a suicide attempt during their *career* (Stanley et al., 2015). Comparatively, the *lifetime* prevalence of suicidal ideation and suicide attempts in the general U.S. population is 5.6–14.3% and 1.9–8.7%, respectively (Nock et al., 2008). These findings suggest that firefighters may experience significantly higher rates of suicidal ideation and suicidal behavior compared to the general population, even over a shorter (i.e., lifetime vs. career) timeframe. These elevated rates underscore the need for studying risk factors for suicidal thoughts and behaviors among firefighters.

One risk factor for suicidal ideation that has been identified in other populations is problematic alcohol use (here, “problematic alcohol use” is used as an umbrella term to describe symptoms of alcohol use disorder; American Psychiatric Association [APA], 2013). For example, a study of a nationally representative cohort of individuals aged 15 to 54 years found that, after accounting for various sociodemographic variables and myriad psychopathologies, alcohol dependence (i.e., disorder with symptoms, such as withdrawal and tolerance, now subsumed within alcohol use disorder; APA, 1987) emerged as one of the strongest indicators of suicide

attempt status (Kessler et al., 1999). Other studies have found positive associations between suicidal thoughts and behaviors and: a) symptoms of alcohol dependence among college undergraduates (Decou and Skewes, 2016); b) frequency of alcohol use among adolescents (Duncan et al., 1997); c) self-reported problems with alcohol among U.S. Airforce personnel (Langhinrichsen-Rohling et al., 2011); d) admittance to psychiatric care for alcohol-related problems among Norwegian military personnel (Rossow and Amundsen, 1995); and e) presence of an alcohol use disorder among Chinese males (Zhang et al., 2010). This body of evidence is notable, given that past research has shown that firefighters also display elevated rates of problematic alcohol use, including frequency of alcohol use (Carey et al., 2011), as well as frequency of binge drinking episodes in a month ($M = 4.9$, compared to 7.4 per year among the general population; Haddock et al., 2015; Naimi et al., 2003) and problems related to alcohol (Haddock et al., 2015, 2012). Given the well-established link between problematic alcohol use and suicidal thoughts and behaviors among other populations discussed above, this high prevalence of problematic alcohol use among firefighters may be a contributing factor to the elevated rates of suicidal thoughts and behaviors seen in this population. However, there is a dearth of studies examining the relationship between problematic alcohol use and suicidal ideation in firefighters specifically.

One exception is a cross-sectional study conducted among 2,883 male firefighters, which found that alcohol dependence had an indirect effect on suicide risk through the pathway of post-traumatic stress and depressive symptoms (Martin et al., 2017). This study suggested that alcohol dependence may confer risk for suicide via post-traumatic stress and depressive symptoms. Though this study has numerous strengths, a limitation in need of addressing is that some evidence indicates that post-traumatic stress and depression can be antecedent to, rather than the

consequents of, alcohol dependence (Farlane, 1998; Peirce et al., 2000; Stewart et al., 2004). Moreover, this study utilized a measure of suicide *risk*, a term that encompasses several distinct constructs (e.g., suicidal ideation, suicide attempts, family history of suicidal thoughts and behaviors) that research suggests have different risk factors (Nock, Kessler, & Franklin, 2016; Nock et al., 2018). Given these limitations, additional studies are needed to further evaluate mechanisms that may underlie the relationship between problematic alcohol use and suicidal ideation, specifically. In identifying candidate mechanisms, a theoretical framework may be useful. One theory that may help elucidate this relationship is the interpersonal theory of suicide (ITS; Joiner, 2005; Van Orden et al., 2010).

According to the ITS, suicidal desire emerges when individuals experience feelings of being a burden to others (i.e., perceived burdensomeness; PB) and a lack of social connection (i.e., thwarted belongingness; TB) and additionally perceive both states to be intractable. The theory also posits that an individual will not attempt suicide unless the individual also has an elevated capability for suicide (e.g., fearlessness about death, physical pain tolerance, familiarity with and access to lethal means). Tests of the theory's postulates have garnered support for the ITS across a variety of samples, including among firefighters (Chu et al., 2016). Indeed, a review and meta-analysis of the ITS found that the interaction between PB and TB demonstrated a significant association with more severe suicidal ideation (Chu et al., 2017). Importantly, the ITS forwards that other risk factors for suicide can be indirectly connected to suicide risk by elevating PB, TB, or capability for suicide.

There have been several studies indicating that PB and TB may explain the relationship between problematic alcohol use and increased risk for suicidal ideation. A review of these studies concluded that the association between suicidal ideation and problematic alcohol use may

be explained by the tendency for alcohol use to be related to interpersonal problems, such as social withdrawal and social marginalization (Pompili et al., 2010). From the framework of the ITS, these conclusions appear to indicate that PB and TB may serve as indirect indicators between problematic alcohol use and suicidal ideation. Indeed, one study examined a similar indirect effects relationship among a sample of college students and found that problems resulting from alcohol use had an indirect effect on suicide proneness (i.e., a construct related to suicide risk) through PB and TB (Lamis and Malone, 2011). Therefore, the present investigation sought to extend this work to firefighters by examining whether problematic alcohol use is indirectly associated with suicidal ideation through PB and TB in two large samples of firefighters. This model (see Figure 1), if supported, may identify possible points of intervention for further study in the treatment of suicidal thoughts among firefighters.

The Present Study

The present study aimed to test whether there is an indirect association between problematic alcohol use and suicidal ideation through PB and TB in two large samples of U.S. firefighters. Based on the ITS and prior research, we made the following hypotheses: (1) problematic alcohol use would have a positive association with PB and TB; (2) PB and TB would have a positive association with suicidal ideation; (3) there would be significant indirect effects between problematic alcohol use and suicidal ideation through PB and TB. Moreover, we examined alternative models to test the specificity of our proposed model.

Study 1: Men and Women Firefighters

We investigated the association between ongoing problematic alcohol use and career suicidal ideation among a nationwide sample of U.S. men and women firefighters and examined

the possible indirect role of ITS constructs (viz., PB and TB) in the association between problematic alcohol use and firefighters' career suicidal ideation.

Method

Participants. Participants included 944 current and retired U.S. firefighters who ranged in age from 18 to 82 years ($M = 38.94$, $SD = 10.68$). Overall, 88.5% of participants identified as male, 88.1% identified as White/European American, 6.7% identified as Native American or Alaska Native, 2.8% identified as Hispanic or Latino/a, 0.5% identified as Asian/Pacific Islander, 0.3% identified as Black/African American, and 1.3% identified their race as Other. Within this sample, 72.2% also reported being married. Respondents reported working as a firefighter for an average of 16.25 years ($SD = 10.68$). Detailed participant demographic characteristics and firefighter occupational experiences are presented in Table 1.

Procedures. This study represents a subset of a larger investigation of behavioral health among current and retired U.S. firefighters ($N = 1,027$; Stanley, Hom, Hagan, & Joiner, 2015). For this study, 944 firefighters provided responses to all variables used in our analyses (see Measures). Participants were recruited via email listservs and social media outlets maintained by fire service organizations. Individuals interested in participating were presented with a web-based informed consent form, and were required to correctly answer five comprehension questions based on the form to enroll in this study. Those who consented to participate completed a 30-minute battery of self-report questionnaires through Qualtrics, a secure, HIPAA-compliant, web-based survey platform. Following completion of the survey, individuals had the option to provide their email addresses to receive a \$10 electronic gift card as compensation for participation. Finally, all participants were provided with a debriefing form, which included information regarding national mental health resources (e.g., the National Suicide Prevention

Lifeline [1-800-237-TALK]). The university's Institutional Review Board (IRB) approved all study procedures.

Measures.

Demographics. Participants completed a brief self-report survey assessing sociodemographic characteristics (e.g., age, sex, race/ethnicity) and firefighter experiences (e.g., rank, department type, years of firefighter service).

Alcohol Use Disorders Identification Test – Consumption (AUDIT-C; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). The AUDIT-C is a 3-item self-report measure used to screen for problematic alcohol use and alcohol use disorders. Items assess the frequency and quantity of alcohol intake (e.g., “How often do you have 6 or more drinks on one occasion?”), with total scores ranging from 0 to 12 and greater scores signaling more problematic alcohol use. Cutoff scores of ≥ 3 for females and ≥ 4 for males have demonstrated good sensitivity and specificity in detecting alcohol misuse (Bradley et al., 2007). The AUDIT-C demonstrated good internal consistency in this study ($\alpha = .80$).

Depressive Symptom Inventory—Suicidality Subscale (DSI-SS; Joiner, Pfaff, & Acres, 2002). A modified version of the 4-item self-report DSI-SS was used in this study. The original DSI-SS assesses frequency and controllability of suicidal thoughts, specificity of suicide plans, and frequency of suicidal urges *over the past two weeks*. For this study, participants provided responses based on the time period *since they became a firefighter* (e.g., “Since becoming a firefighter, there has been a time when...”). This change in wording was done in the original study given its objective of identifying risk factors for, and examining prevalence rates of, suicidal ideation during firefighter's careers. Composite scores of ≥ 3 are considered elevated (Joiner et al., 2002). Participants rated each item (e.g., 0 “N/A – I have not had thoughts of killing myself”

to 4 (“*I always had thoughts of killing myself*”), with total scores ranging from 0 to 12 and higher scores signaling greater suicidal symptom severity. The original DSI-SS has demonstrated strong internal consistency and convergent validity, and it has been identified as a particularly useful population-based measure of suicidal ideation severity (Batterham et al., 2015). The modified DSI-SS utilized in this study demonstrated excellent internal consistency ($\alpha = .91$).

Interpersonal Needs Questionnaire (INQ; Van Orden, Cukrowicz, Witte, & Joiner, 2012). The INQ is a 15-item self-report measure of TB (9 items; e.g., “*These days, I often feel like an outsider in social gatherings.*”) and PB (6 items; e.g., “*These days the people in my life would be better off if I were gone.*”). Participants rated the extent to which each item reflects how they had been feeling “recently” on a 1 (*Not at all true for me*) to 7 (*Very true for me*) Likert scale. Total scores on the INQ-TB and INQ-PB range from 7 to 63 and 7 to 42, respectively, with higher scores representing a greater degree of experiencing each respective construct. Both subscales have demonstrated good internal consistency and predictive validity in prior studies (Van Orden et al., 2012), and both demonstrated strong internal consistency in this sample (INQ-TB: $\alpha = .91$; INQ-PB: $\alpha = .97$).

Data Analytic Strategy. For our missing data approach, we used Maximum Likelihood, which operates under the assumption of at least missing at random (MAR) or missing completely at random (MCAR; Dong and Peng, 2013). To test for the assumption of MCAR, we conducted Little’s test (Little, 1988). Results were significant $\chi^2(17) = 65.35, p < .001$, indicating that the data are not MCAR. With no formal test of MAR, we used *T*-tests and chi-square tests to examine differences in gender, race, age, years of firefighter service, and firefighter status (current vs. retired) between participants without any missing data and those with missing data. Analyses revealed that these groups significantly differed in age ($\Delta M = 5.60$) and; years of

service as a firefighter ($\Delta M = 6.41$), indicating that those with missing data tended to be younger and have fewer years of service as a firefighter than those without missing data. Analyses also revealed that race/ethnicity was related to having missing data, such that these groups differed in the proportion of those identifying as White/European American, and as Native American or Alaska Native. Missingness was not related to any other variables (i.e., gender and firefighter status).

We used IBM SPSS Version 23 to conduct preliminary bivariate correlations between our variables. Next, to test our hypotheses that INQ-PB and INQ-TB would significantly account for the relationship between AUDIT-C problematic alcohol use and DSI-SS career suicidal ideation, we conducted path analyses in Mplus Version 7.4, with years of firefighter service, race/ethnicity, firefighter status (i.e., current vs. retired), and gender entered as covariates. Age was not included as a covariate given its high correlation with years of firefighter service ($r = .79$). To test the specificity of this model, additional path analyses were conducted to examine whether AUDIT-C problematic alcohol use significantly accounted for the association between (1) INQ-TB and DSI-SS career suicidal ideation and (2) INQ-PB and DSI-SS career suicidal ideation, while controlling for the same covariates as our first model. We utilized bootstrapping with 5,000 bootstrap resamples to obtain 95% confidence intervals (CI) around the standardized coefficients in all models. Effects were considered statistically significant if the 95% CI did not contain zero.

Results

Table 2 contains descriptive statistics and bivariate correlations for this study's variables. As expected, DSI-SS career suicidal ideation, INQ-PB, and INQ-TB were all positively correlated with problematic alcohol use. In this sample, 410 (43.4%) firefighters reported a history of career suicidal ideation on the DSI-SS (i.e., DSI-SS total scores ≥ 3). In the current

sample, 544 (63.0%) men and 52 (64.2%) women met the clinical cutoff for the AUDIT-C, indicating problematic alcohol use.

For direct effects, see Table 3. Within the proposed model, with PB and TB entered as mediators, and with years as a firefighter, gender, race/ethnicity, and firefighter status entered as covariates,¹ problematic alcohol use demonstrated an indirect effect on career suicidal ideation through PB ($\beta = 0.05$, $SE = 0.02$, 95% CI [0.02, 0.08]), but not TB ($\beta = 0.01$, $SE = 0.01$, 95% CI [0.00, 0.02]). Thus, heightened problematic alcohol use was associated with higher perceived burdensomeness, and in turn, higher rates of suicidal ideation. The direct effect between problematic alcohol use and career suicidal ideation was not significant ($\beta = 0.05$, $SE = 0.02$, 95% CI [0.00, 0.10]).

Within the first alternative model, with PB as the predictor variable and problematic alcohol use and TB entered as mediators, PB had an indirect effect on career suicidal ideation through TB ($\beta = 0.04$, $SE = 0.01$, 95% CI [0.03, 0.06]) but not through problematic alcohol use ($\beta = 0.00$, $SE = 0.00$, 95% CI [0.00, 0.01]). Therefore, greater PB was associated with higher TB, which, in turn, is associated with higher rates of suicidal ideation.

In the next alternative model, with TB as the predictor and problematic alcohol use and PB as the mediators, TB had an indirect effect on career suicidal ideation through PB ($\beta = 0.05$, $SE = 0.00$, 95% CI [0.04, 0.06]) but not problematic alcohol use ($\beta = 0.00$, $SE = 0.00$, 95% CI [0.00, 0.00]). This finding indicates that greater TB was associated with greater PB, and in turn, more suicidal ideation. Within both alternative models, direct effects (see Table 3) between PB and career suicidal ideation and between TB and career suicidal ideation remained significant, while the direct effect between problematic alcohol use and career suicidal ideation was non-significant.

Study 2: Women Firefighters

We utilized a second sample consisting of only female firefighters to test our hypothesis that PB and TB serve as indirect indicators in the relationship between problematic alcohol use and career suicidal ideation. Moreover, we used Study 2 to address the gender imbalance observed in Study 1, and to investigate whether our proposed indirect effects model replicated using a distinct measure of suicidal ideation.

Methods

Participants. Participants were 241 current women U.S. firefighters who ranged in age from 18 to 59 years ($M = 37.30$, $SD = 9.70$). Overall, 92.9% identified as White/European American, 2.5% identified as Black/African American, 1.2% identified as Hispanic or Latina, 0.8% identified as Native American or Alaska Native, 0.4% identified as Asian/Pacific Islander, and 2.1% identified as Other. Within this sample, 51.5% reported being married. Respondents reported working as a firefighter for an average of 12.45 years ($SD = 8.01$). Detailed participant demographic characteristics and firefighter occupational experiences are presented in Table 1.

Measures.

Demographics. Participants completed a brief self-report assessment of sociodemographic characteristics (e.g., age, sex, race/ethnicity) and firefighter experiences (e.g., rank, department type, years of firefighter service).

AUDIT-C (Bush et al., 1998). See Study 1 for a detailed description of the AUDIT-C. The AUDIT-C demonstrated workable but suboptimal internal consistency for this sample ($\alpha = .66$).

Self-Injurious Thoughts and Behaviors Interview—Short Form (SITBI-SF; Nock, Holmberg, Photos, & Michel, 2007). The 72-item SITBI-SF is a measure of the nature and

timing of past suicidal thoughts and behaviors. For the current study, we modified the SITBI-SF for use as a self-report measure to assess suicidality experienced during participants' firefighting careers. Similar to study 1, this was done in the original study our sample was derived from given the study's focus on identifying risk factors for, and examining the prevalence of, suicidal thoughts and behaviors during firefighter's careers. Specifically, we modified the original item of the SITBI-SF assessing lifetime suicidal ideation to reflect presence of suicidal ideation during the firefighter's career ("Since becoming a firefighter, have you ever had thoughts of killing yourself?" [Yes/No]) as our index of suicidal thoughts. Previous studies have similarly utilized the SITBI-SF as a self-report measure (Zetterqvist et al., 2013). The SITBI-SF has been shown to have good psychometric properties, including high internal and test-retest reliability, as well as moderate-to-high concurrent validity (Nock et al., 2007).

INQ (Van Orden et al., 2012). See Study 1 for a detailed description of the INQ. Both INQ subscales demonstrated excellent internal consistency for the present sample (INQ-TB: $\alpha = .92$; INQ-PB: $\alpha = .94$).

Procedure. Data from a larger investigation of women firefighter behavioral health were utilized for this study ($N = 313$; Stanley, Hom, Spencer-Thomas, & Joiner, 2017). Participants who completed all measures of interest ($n = 241$) were included in the present study. For Study 2, the same procedures were utilized as in Study 1; however, for compensation, individuals in Study 2 were able to provide their email addresses to be entered into a raffle to receive 1 of 15 \$20 electronic gift cards. The university's IRB approved all study procedures.

Data Analytic Plan. Study 2 employed largely the same data analytic approach as Study 1, with a couple of differences: (1) missing data were handled with Maximum Likelihood with Monte Carlo integration; (2) SITBI-SF career ideation was utilized as the dependent variable,

rather than DSI-SS career suicidal ideation. It should be noted that this dichotomous variable results in a conceptual loss in statistical power to detect effects (Altman and Royston, 2006), especially given that suicidal ideation is considered a continuum (Silverman et al., 2007). Little's Test was conducted to test for MCAR and was significant $\chi^2(11) = 114.43, p < .001$, indicating that our data are not MCAR. We also conducted *T*-tests and a Pearson Chi-Square tests to investigate whether those with missing data differed from those without any missing data in age, years of service as a firefighter, or race/ethnicity. All tests were non-significant ($p > .05$). We included years of service as a firefighter and race/ethnicity as covariates. We did not include age as a covariate given its high correlation with years of service as a firefighter ($r = .71$).

Results

Table 2 presents means, standard deviations, and bivariate correlations for all Study 2 variables. In line with expectations, all suicide-related variables and problematic alcohol use were positively correlated. In this sample, 97 (40.2%) firefighters reported a history of career suicidal ideation according to the SITBI-SF and 164 (68.0%) met the clinical cutoff for problematic alcohol use according to the AUDIT-C.

See Table 3 for direct effects of all models for this sample. Within the first model, with problematic alcohol use as the predictor, PB and TB as mediators, and years as a firefighter and race included as covariates, problematic alcohol use had an indirect effect on career suicidal ideation through TB ($\beta = 0.09, SE = 0.04, 95\% CI [0.03, 0.17]$), and PB ($\beta = 0.07, SE = 0.04, 95\% CI [0.02, 0.19]$). These results indicate that problematic alcohol use is associated with greater levels of TB and PB, which, in turn, result in higher suicidal ideation. Problematic alcohol use did not have a direct effect on career suicidal ideation after accounting for other variables ($\beta = 0.01, SE = 0.08, 95\% CI [-0.16, 0.17]$).

Our first alternative model, with PB as the predictor and problematic alcohol use and TB entered as mediators revealed that PB had an indirect effect on career suicidal ideation through TB ($\beta = 0.08$, $SE = 0.02$, 95% CI [0.04, 0.12]) but not through problematic alcohol use ($\beta = 0.00$, $SE = 0.01$, 95% CI [-0.01, 0.01]). PB also had a direct effect on career suicidal ideation ($\beta = 0.15$, $SE = 0.06$, 95% CI [0.07, 0.30]).

Our second alternative model, with TB entered as the predictor variable and problematic alcohol use and PB entered as mediators, indicated that TB had an indirect effect on career suicidal ideation through PB ($\beta = 0.04$, $SE = 0.02$, 95% CI [0.02, 0.08]) but not through problematic alcohol use ($\beta = 0.00$, $SE = 0.00$, 95% CI [-0.01, 0.01]). TB also had a direct effect on career suicidal ideation ($\beta = 0.07$, $SE = 0.02$, 95% CI [0.05, 0.11]).

Discussion

The present investigation examined whether PB and TB account for the relationship between problematic alcohol use and career suicidal ideation in two large samples of firefighters. Findings revealed high rates of clinical levels of problematic alcohol use among a sample of mostly male firefighters (63.1%), as well as a female firefighter sample (68.0%). These findings coincide with previous literature suggesting that firefighters tend to have higher rates of problematic alcohol use compared to the general population (Carey, Al-Zaiti, Dean, Sessanna, & Finnell, 2011; Haddock, Poston, Jahnke, & Jitnarin, 2017; Haddock et al., 2012; Haddock, Day, Poston, Jahnke, & Jitnarin, 2015). Previous work indicates that this high rate of problematic alcohol use among firefighters may be, in part, the result of repeated exposure to traumatic incidents (Harvey et al., 2016). Specifically, firefighters' experiences with traumatic incidents increases the likelihood for the development of posttraumatic stress symptoms, resulting in firefighters using alcohol as a coping mechanism for these symptoms (Tomaka et al., 2017).

Thus, though posttraumatic stress symptoms were not examined in this study, there is reason to conclude that posttraumatic stress symptoms contributed to the high rate of problematic alcohol use observed in our samples.

Our results partially supported our hypothesis that PB and TB would both serve as explanatory factors in the relationship between problematic alcohol use and suicidal ideation. Contrary to our hypotheses, in Study 1, we found that problematic alcohol use had an indirect effect on career suicidal ideation through PB, but not TB. In contrast, in Study 2, we found that problematic alcohol use had an indirect effect on career suicidal ideation through PB and TB. While there are many explanations for these divergent results, the most likely candidate is the differences in gender between our samples. Within this context, TB appears less relevant to the relationship between problematic alcohol use and suicidal ideation among male firefighters than among female firefighters. A possible driver of this pattern of findings is that there is some evidence that the relationship between suicidal ideation, and the constructs of the ITS is moderated by gender, with TB emerging as the sole predictor of suicidal ideation (between PB and TB) among women (Donker et al., 2014). Moreover, women may place greater importance on their relationships with other people as a source of happiness when compared to men (Crossley and Langdrige, 2005), making TB a stronger risk factor for suicidal ideation among women. However, a recent meta-analysis of the ITS did not find this moderation effect (Chu et al., 2017). Therefore, the discrepant results between our samples may be unique to firefighters. Specifically, among a largely sample of male firefighters, comradery and tradition were noted as two of the main reasons for drinking in the fireservice (Jahnke et al., 2014). Thus, among male firefighters, drinking may be an in-group norm that facilitates feelings of belonging, thereby making problematic alcohol use a driver of *decreased* TB. In contrast, women firefighters may

be less likely to feel integrated into the culture of the fireservice (including drinking as a source of comradery) given rates of experiencing workplace harassment observed in this subgroup of firefighters (Hom et al., 2017).

Regarding PB, it is striking that problematic alcohol use demonstrated an indirect effect on suicidal ideation through PB in both samples. This finding is in line with previous work among college students (Lamis and Malone, 2011), and lends more support to the hypothesis that PB has a stronger association with suicidal ideation than does TB (Chu et al., 2017). Given the absence of research examining how PB might develop in firefighters, we can only point to other constructs that may relate to PB examined in other populations to help interpret how problematic alcohol use may lead to PB within firefighters.

Specifically, problematic alcohol use has been shown to be associated with work related problems (Ames et al., 1997). This link between problematic alcohol use and work-related problems may contribute to loss of meaning and purpose and therefore lead to one feeling like a burden on family and society (Iacovides et al., 2003), resulting in increased PB (Van Orden et al., 2010). Furthermore, previous research has found an association between problematic alcohol use and perceived lower quality of life among those close to the individual, especially when these individuals are caregivers for the one engaging in the problematic alcohol use (Jiang et al., 2015). Thus, firefighters engaging in problematic alcohol use may also perceive lower quality of life in those around them that, they presume, is due to their drinking. This perception may then lead them to evaluate themselves as a burden and thereby increasing their risk for thoughts of suicide.

Our findings carry some implications. First, our findings suggest that—if supported by longitudinal and, where possible, experimental designs—PB and TB may be targeted by

treatment to reduce suicidal ideation among firefighters. Indeed, evidence suggests that most firefighters access mental health treatment during their career (Hom et al., 2016), and the development of treatment protocols tailored to the unique stressors and maintaining factors present in firefighters could help begin to address the high rates of psychiatric symptoms among this population. Similarly, if the results in the present study are supported by longitudinal data in a representative sample of firefighters, providers may also consider gender when treating firefighters for problematic alcohol use and suicidal ideation.

Limitations and Future Directions

Our study's findings should be interpreted within the context of its limitations. First, both studies employed cross-sectional designs. In turn, though we analyzed alternative models to help bolster evidence for the specificity of our model, we emphasize that causal or directional conclusions cannot be made based on our data. Second, we did not derive our samples using populationally representative sampling methods. Thus, our samples mostly (or completely, in Study 2) consisted of career firefighters, while most firefighters in the U.S. are volunteers (Haynes and Stein, 2017). Given this fact, our sample may have higher rates of problematic alcohol use than the fireservice population (Stanley et al., 2017). Relatedly, the study was advertised as a study of mental health among firefighters, potentially increasing the amount of individuals with more severe presentations participating in the study. Third, though we added gender as a covariate in Study 1, the low number of women firefighters in this sample may have had insufficient power to detect a moderating effect. Fourth, in Study 2, we utilized a modified self-report version of the SITBI-SF. Though the SITBI-SF has been used as a self-report measure before (Zetterqvist et al., 2013), it was not originally validated as one. Within this regard, future studies are warranted to examine the validity of a self-report version of the SITBI-SF, as well as

examine the validity of the modified measure used to assess suicidal thoughts and behaviors during firefighters' careers.

Future work may consider addressing some of the limitations of this study. For example, longitudinal designs with three time-points could better determine the directionality and temporality of the relationships among problematic alcohol use, PB and TB, and suicidal ideation. In addition to addressing the limitations found in this study, future studies may consider examining how PB and TB develop over time among firefighters. Such studies would improve our ability to better understand how these constructs operate across gender, race, and other demographics, among firefighters.

Conclusions

Firefighters are at increased risk for both problematic alcohol use and suicidal ideation. Past research has implicated problematic alcohol use in increased risk for suicidal ideation, and the present investigation has extended this finding to two large samples of firefighters. Importantly, the results of the present studies indicate that two core constructs of the interpersonal theory of suicide—perceived burdensomeness and thwarted belongingness—were supported as indirect indicators of the relationship between problematic alcohol use and career suicidal ideation, with perceived burdensomeness emerging as the stronger and more consistent explanatory factor. Results implicate that problematic alcohol use on suicidal ideation could potentially be understood as the result of interpersonal constructs. However, additional work is needed to replicate these findings using methods more amenable to examining temporality between these constructs and their relation to suicidal thoughts.

Footnotes

¹Given that depression is highly comorbid with alcohol use problems, TB, PB, and suicidal ideation, we conducted exploratory analyses to evaluate whether findings remained the same when controlling for depression symptoms. For Study 1, the same pattern of findings emerged when controlling for depression symptom severity (Center for Epidemiologic Studies Depression Scale; Radloff, 1977); however, for Study 2, all direct and indirect effects of AUDIT-C scores were reduced to non-significant coefficients (using CESD-R; Eaton, Smith, Ybarra, Muntaner, & Tien, 2004). We would like to note recent evidence that suggests that covarying out depression when the outcome is suicidal ideation causes suicidal ideation to lose its integrity as a construct (Rogers et al., 2016). Thus, it may not be conceptually meaningful to examine predictors of suicidal ideation when controlling for depression within the current investigation.

Author Statement

Contributors:

Austin J. Gallyer was responsible for study hypotheses, conducting and interpreting analyses, and writing and editing of the manuscript.

Sean P. Dougherty was responsible for writing and editing the manuscript.

Anna R. Gai was responsible for writing and editing the manuscript.

Ian H. Stanley and Melanie A. Hom were responsible for gathering of original data. They also assisted in the editing of the manuscript.

Megan L. Rogers was responsible for assisting in analyses and editing of the manuscript

Mary E. Duffy was responsible for editing the manuscript.

Jennifer M. Buchman-Schmitt was responsible for editing the manuscript.

Sally Spencer-Thomas was integral in gathering of original data for the women firefighter study.

Thomas E. Joiner was responsible for providing financial support and editing of the manuscript.

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Declaration of Interest

None.

ACCEPTED MANUSCRIPT

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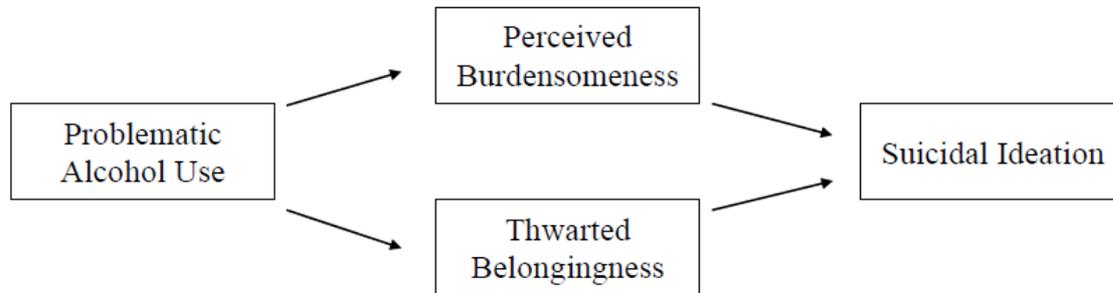


Figure 1. Hypothesized relationship between problematic alcohol use and suicidal ideation.

Table 1

Sociodemographic and Occupational Characteristics of Sample 1 and Sample 2

Characteristics	# Sample 1 (N = 944)	Valid Sample 1 (%)	# Sample 2 (N = 241)	Valid Sample 2 (%)
Age				
18-24 Years	118	12.5	22	9.1
25-34 Years	246	26.1	76	31.6
35-44 Years	282	29.8	83	34.4
45-54 Years	207	22.0	53	22.0
55+	91	9.6	7	2.9
Sex				
Male	863	91.4	0	0.0
Female	81	8.6	241	100
Race/Ethnicity				
White/European American	835	88.5	224	92.9
Black/African American	3	0.3	6	2.5
Hispanic or Latino/a	26	2.8	3	1.2
Asian/Pacific Islander	5	0.5	1	0.4
Native American or Alaska Native	63	6.7	2	0.8
Other	12	1.3	5	2.1
Marital Status				
Married	680	72.0	124	51.5
Divorced or separated	93	9.9	38	15.8
Widowed	6	0.6	3	1.2
Never Married	165	17.5	76	31.5
Years of Service as Firefighter				
0-10 Years	363	38.5	108	44.8
11-20 Years	259	27.4	97	40.3
21-30 Years	216	22.9	30	12.4
31+ Years	106	11.2	6	2.5
Firefighter Status				
Current	848	89.8	241	100
Retired	96	9.6	0	0.0

Note: Sample 1 age (M = 38.94; SD = 11.61; Range 18-82), years of service as a firefighter (M = 16.25; SD = 10.68; Range = 0.5-60). Sample 2 age (M = 37.59; SD = 9.51; Range = 19-58), years of service as a firefighter (M = 12.45; SD = 8.01; Range = 1-39).

Table 2

Means, Standard Deviations, Ranges, and Bivariate Correlations of Study 1 and Study 2

Variables.

Study 1 Variable	1	2	3	4
1. INQ-TB	1			
2. INQ-PB	.54 ^{***}	1		
3. DSI-SS	.46 ^{***}	.55 ^{***}	1	
4. AUDIT-C	.08 [*]	.19 ^{***}	.15 ^{***}	1
Mean	23.99	10.18	2.09	4.43
Standard Deviation	12.61	7.81	2.40	2.76
Range	9–62	6–42	0–12	0–13
Study 2 Variable	1	2	3	4
1. INQ-TB	1			
2. INQ-PB	.52 ^{***}	1		
3. SITBI-SF	.51 ^{***}	.44 ^{***}	1	
4. AUDIT-C	.20 ^{**}	.16 ^{**}	.14 [*]	1
5. Years of Firefighter Service	.01	-.10	-.03	.03
Mean	25.78	9.34	0.40	3.70
Standard Deviation	12.91	6.36	0.49	2.03
Range	9–59	6–39	0–1	1–10

Note: ^{***} $p < .001$; ^{**} $p < .01$; ^{*} $p < .03$; Two-tailed. AUDIT-C used to measure problematic alcohol use, perceived burdensomeness and thwarted belongingness measured by INQ, suicidal ideation measured by DSI-SS.

Table 3

Direct Effects in Mediation Models for Study 1 and Study 2.

Study 1 Model	Predictor Variable	Outcome Variable	β	<i>SE</i>	95% CI
X = AL	AL	SI	0.05	0.03	0.00, 0.10
M ₁ = PB	AL	TB	0.22	0.14	-0.09, 0.52
M ₂ = TB	AL	PB	0.34	0.09	0.17, 0.54
X = PB	PB	AL	0.05	0.02	0.03, 0.08
M ₁ = AL	PB	TB	0.99	0.05	0.89, 1.08
M ₂ = TB	PB	SI	0.15	0.01	0.13, 0.18
X = TB	TB	AL	0.01	0.01	0.00, 0.03
M ₁ = AL	TB	PB	0.30	0.02	0.26, 0.34
M ₂ = TB	TB	SI	0.04	0.01	0.03, 0.05
Study 2 Model	Predictor Variable	Outcome Variable	β	<i>SE</i>	95% CI
X = AL	AL	SI	0.01	0.08	-0.16, 0.17
M ₁ = PB	AL	TB	1.21	0.45	0.31, 2.06
M ₂ = TB	AL	PB	0.48	0.19	0.15, 0.90
X = PB	PB	AL	0.05	0.02	0.02, 0.10
M ₁ = AL	PB	TB	1.10	0.11	0.90, 1.34
M ₂ = TB	PB	SI	0.15	0.06	0.07, 0.30
X = TB	TB	AL	0.02	0.01	0.01, 0.06
M ₁ = AL	TB	PB	0.25	0.03	0.19, 0.32
M ₂ = TB	TB	SI	0.07	0.02	0.05, 0.11

Note: Outcome variable of all analyses was suicidal ideation; Years as a firefighter entered as covariate for all analyses; CI = Confidence Interval; PB = Perceived Burdensomeness; TB = Thwarted Belongingness; AL = Alcohol Use; SI = Suicidal Ideation; 5000 bootstrap resamples.