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Wildland firefighters and suicide risk: Examining the role of social disconnectedness

Ian H. Stanley*, Melanie A. Hom, Anna R. Gai, Thomas E. Joiner

Department of Psychology, Florida State University, Tallahassee, FL 32306, USA

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ABSTRACT

Recent research has indicated that firefighters are at elevated suicide risk. Fire service organizations have called for research to examine fire service subgroups that might be at relatively increased suicide risk. Although anecdotal reports suggest that wildland firefighters represent one such group, to our knowledge, no study has empirically examined this conjecture. Thus, the present investigation examined if wildland firefighters report greater levels of suicide risk than non-wildland firefighters. Moreover, we sought to determine if two constructs proposed by the interpersonal theory of suicide to comprise suicidal desire—thwarted belongingness and perceived burdensomeness—statistically explain the link between wildland firefighter status and suicide risk. Merged data from two nationwide investigations of firefighter mental health were utilized ($N = 1,131$; 68.2% male, 89.4% White). A total of 1.8% ($n = 20$) of the sample identified as wildland firefighters. Compared to non-wildland firefighters, wildland firefighters reported greater levels of suicide risk. Thwarted belongingness, but not perceived burdensomeness, statistically explained this link. Findings suggest that programs enhancing social connectedness within the fire service, particularly among wildland firefighters, might be one avenue for suicide prevention among firefighters. Results of this novel investigation should be interpreted in light of the relatively small subgroup of wildland firefighters.

1. Introduction

Research has demonstrated that firefighters report elevated rates of suicidal thoughts and behaviors (Stanley et al., 2015, 2017b) and die by suicide at higher rates compared to other occupational groups (see McIntosh et al., 2016, for data on suicide rates by occupational group). As such, research into the understanding and prevention of suicide among firefighters has been identified as a critical priority (Henderson et al., 2016; International Association of Fire Chiefs [IAFC], 2017; National Fallen Firefighters Foundation [NFFF], 2016; Stanley et al., 2016).

Leading fire service organizations have advocated for the identification of fire service subgroups that might be at relatively increased risk for reporting suicidal thoughts and behaviors, in an effort to efficiently provision resources (e.g., NFFF, 2016). In response to this call, Stanley et al. (2017a) found that volunteer firefighters were more likely than career firefighters to report a history of suicidal behaviors and reported more severe suicide-related psychiatric symptoms (e.g., PTSD; Boffa et al., 2017; Stanley et al., 2017c). Importantly, the authors also found that relatively limited access to mental health services among volunteer firefighters statistically explained the elevated levels of

psychiatric symptomatology among this group, signaling a potential point of intervention. Additional research is needed, however, to examine other subgroups within the fire service.

Recently, several media reports have suggested that wildland firefighters may represent an at-risk fire service subgroup (Hansman, 2017). The precise number of individuals within the U.S. fire service who serve as wildland firefighters is, to our knowledge, not published (see Haynes and Stein, 2017, for a comprehensive profile of the U.S. fire service). However, it is important to acknowledge that wildland firefighters represent a relatively small proportion of the estimated 1,160,450 firefighters in the U.S. (Haynes and Stein, 2017). Some wildland firefighters work in full-time capacities while others work in either permanent or temporary seasonal positions (e.g., National Park Service, 2018). Simply, wildland firefighters are tasked with combating wildfires. They are deployed to areas as needed and often spend protracted periods of time away from their families and friends when deployed. In addition, a wildland crew composition is generally unique from other fire departments, with different configurations of firefighters comprising specialized groups for each contract (e.g., National Wildfire Coordinating Group, 2017). For instance, when a wildfire occurs, in addition to wildland firefighters who work for

* Corresponding author.

E-mail address: stanley@psy.fsu.edu (I.H. Stanley).

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Table 1
Participant sociodemographic and firefighter experience characteristics

| Characteristic | Full sample (N = 1,131) | Wildland firefighters (n = 20) | Non-wildland firefighters (n = 1,111) |
|--|---|--|--|
| Age, Mean (SD) | 37.37 year (10.52 years) [Range: 18–76 years] | 34.30 year (10.75 years) [Range: 23–58 years] | 37.42 year (10.51 years) [Range: 18–76 years] |
| Sex, n (Valid %) | | | |
| Male | 771 (68.3%) | 10 (50.0%) | 761 (68.6%) |
| Female | 358 (31.7%) | 10 (50.0%) | 348 (31.4%) |
| Missing | 2 (–) | 0 (–) | 2 (–) |
| Race/Ethnicity, n (Valid %) | | | |
| White/Caucasian | 1,011 (89.4%) | 19 (95.0%) | 992 (89.3%) |
| Black/African American | 9 (0.8%) | 0 (0.0%) | 9 (0.8%) |
| Hispanic or Latino/a | 26 (2.3%) | 0 (0.0%) | 26 (2.3%) |
| Asian/Pacific Islander | 6 (0.5%) | 0 (0.0%) | 6 (0.5%) |
| Native American or Alaska Native | 62 (5.5%) | 0 (0.0%) | 62 (5.6%) |
| Other | 17 (1.5%) | 1 (5.0%) | 16 (1.4%) |
| Marital Status, n (Valid %) | | | |
| Married | 764 (67.6%) | 10 (50.0%) | 754 (67.9%) |
| Divorced or Separated | 110 (9.7%) | 1 (5.0%) | 109 (9.8%) |
| Widowed | 9 (0.8%) | 0 (0.0%) | 9 (0.8%) |
| Never Married | 248 (21.9%) | 9 (45.0%) | 239 (21.5%) |
| Education, n (Valid %) | | | |
| Did not complete high school | 6 (0.5%) | 1 (5.0%) | 5 (0.5%) |
| High school graduate/GED | 75 (6.6%) | 2 (10.0%) | 73 (6.6%) |
| Some college | 339 (30.0%) | 1 (5.0%) | 338 (30.5%) |
| 2 years college | 256 (22.7%) | 4 (20.0%) | 252 (22.7%) |
| 4 years college | 316 (28.0%) | 9 (45.0%) | 307 (27.7%) |
| Post-graduate education | 138 (12.2%) | 3 (15.0%) | 135 (12.2%) |
| Missing | 1 (–) | 0 (–) | 1 (–) |
| Total years of service, Mean (SD) | 14.36 years (9.76 years) [Range: 0.5–60 years] | 12.70 years (10.86 years) [Range: 2–35 years] | 14.39 (9.74) [Range: 0.5–60 years] |
| Fire department type, n (Valid %) | | | |
| Career | 466 (41.2%) | 0 (0.0%) | 466 (41.9%) |
| Volunteer | 317 (28.0%) | 0 (0.0%) | 317 (28.5%) |
| Combination (Career and Volunteer) | 322 (28.5%) | 0 (0.0%) | 322 (29.0%) |
| Military | 6 (0.5%) | 0 (0.0%) | 6 (0.5%) |
| Wildland | 20 (1.8%) | 20 (100%) | 0 (0.0%) |

government agencies, the government contracts firefighters from the private sector to fill a wildland crew. These private companies pull from a registry of certified wildland firefighters to configure their crews. As such, wildland firefighters, on average, may not have the same degree of camaraderie with fellow firefighters as firefighters in non-wildland roles, potentially contributing to a diminished sense of belongingness.

Indeed, the interpersonal theory of suicide predicts that suicidal thoughts emerge in the context of perceived social disconnectedness (Joiner, 2005; Van orden et al., 2010). According to the interpersonal theory of suicide, indices of social disconnectedness include thwarted belongingness (i.e., loneliness, absence of reciprocal care) and perceived burdensomeness (i.e., the belief that one's death is worth more than one's life to others, self-hate). The theory proposes that thwarted belongingness and perceived burdensomeness, when perceived as intractable, are each necessary but not sufficient for the emergence of serious suicidal thoughts. A recent meta-analysis has provided empirical support for theory predictions and has also uncovered that thwarted belongingness and perceived burdensomeness might, in some instances, each exert effects on suicidality independent of one another, a finding contrary to theoretical predictions (Chu et al., 2017). As noted, and consistent with anecdotal reports (Gabbert, 2017; Hansman, 2017; Keller, 2017), wildland firefighters are presented with conditions under which perceptions of social disconnectedness, including loneliness (cf. thwarted belongingness), may emerge. Moreover, a recent eusociality-based account of suicide suggests that individuals who display self-sacrificial tendencies, such as firefighters, might be at increased suicide risk if these self-sacrificial tendencies misfire and one perceives his/her death as worth more than his/her life (cf. perceived burdensomeness; Joiner et al., 2016). Thus, there is theoretical rationale to suspect that suicide risk might be elevated among wildland firefighters and that interpersonal theory of suicide constructs might account for this link. However, to our knowledge, no study has

empirically examined this conjecture.

Consistent with the mission to identify fire service subgroups at relatively increased suicide risk to inform the provision of appropriate suicide prevention services (NFFF, 2016), we endeavored to examine if wildland firefighters report suicidal symptoms at a higher rate compared to non-wildland firefighters. We also sought to determine if indices of the interpersonal theory of suicide statistically explain this link. Specifically, we hypothesized that wildland firefighter status would be associated with increased suicide risk and that this association would be statistically accounted for by higher levels of both thwarted belongingness and perceived burdensomeness. We examined thwarted belongingness and perceived burdensomeness as parallel mediators in our primary model. However, because of the high correlation between thwarted belongingness and perceived burdensomeness, considering these variables separately provides clinically important information (see Mitchell et al., 2017, for discussion); thus, we additionally examined thwarted belongingness and perceived burdensomeness as individual mediators in separate models. Determining if indices of social disconnectedness might account for the link between wildland firefighter status and suicide risk has logistical import as it would signal a point of intervention—that is, ensuring adequate social supports are provisioned for wildland firefighters (cf. Stanley et al., 2018).

2. Methods

2.1. Participants and procedures

Merged data from two large, nationwide studies of firefighters were utilized for the present study (Stanley et al., 2017b, 2015). Data were merged to increase the sample size of wildland firefighters represented, given that wildland firefighters represent a relatively small subset of the fire service (Haynes and Stein, 2017) and proportionately fewer

wildland firefighters participated in those studies. Details on the methods of these two studies have been reported elsewhere (Stanley et al., 2017b, 2015). Only current (versus retired) firefighters were selected for the present analyses since only current firefighters were recruited from one of the samples. This approach resulted in a combined sample of 1,131 firefighters with complete data on variables of interest (68.2% male, 89.4% White, mean[SD] age = 37.37[10.52] years, mean[SD] years as a firefighter = 14.36[9.76] years). A total of 20 (1.8%) respondents identified as wildland firefighters; there were no statistically significant differences in age, sex, race, or years of service as a firefighter between wildland and non-wildland firefighters ($p > 0.05$). Please see Table 1 for additional details on participant demographic and firefighter characteristics for the full sample and stratified by firefighter type (i.e., wildland and non-wildland). Notably, the combined sample represents proportionately fewer males than one would expect given the demographics of the U.S. fire service (Haynes and Stein, 2017); this is because one sample exclusively recruited female firefighters (Stanley et al., 2017b), in part due to the dearth of health data on female firefighters (Jahnke et al., 2012).

Both studies recruited participants from e-mail listservs and social media outlets managed by several firefighter organizations. Following the web-based informed consent process for which participants were required to correctly answer a series of multiple-choice comprehension questions, participants completed an approximately 30 min Web-based survey via Qualtrics. Following completion of the survey, all participants were presented with information for national mental health resources, such as the National Suicide Prevention Lifeline (1-800-273-TALK). The University's Institutional Review Board approved all study procedures.

2.2. Measures

2.2.1. Suicidal Behaviors Questionnaire—Revised (SBQ-R; Osman et al., 2001)

The 4-item SBQ-R was used to index suicide risk. Higher scores indicate greater suicide risk. The SBQ-R has strong psychometric properties and can validly differentiate between suicidal and non-suicidal subgroups (Batterham et al., 2015; Osman et al., 2001); a cutoff score of 7 among non-psychiatric samples has been identified as indicating clinically significant suicide risk (Osman et al., 2001). Within the current sample, the SBQ-R demonstrated good internal consistency ($\alpha = 0.84$).

2.2.2. Interpersonal Needs Questionnaire (INQ; Van Orden et al., 2012)

The 15-item INQ was used to index thwarted belongingness (INQ-TB; 6 items) and perceived burdensomeness (INQ-PB; 9 items). Higher scores indicate greater levels of thwarted belongingness or perceived burdensomeness. Both INQ subscales have demonstrated good internal consistency and predictive validity for suicidal ideation (Van Orden et al., 2012). Within the current sample, the INQ demonstrated excellent internal consistency (INQ-TB, $\alpha = 0.91$; INQ-PB, $\alpha = 0.97$).

2.3. Data analytic approach

Analyses of covariance (ANCOVAs) were utilized to determine differences in SBQ-R, INQ-TB, and INQ-PB scores between wildland and non-wildland firefighters (wildland firefighters = 1, non-wildland firefighters = 0), controlling for sex. Of note, ANCOVAs assume homogeneity of variance and unequal group sizes may violate this assumption. Thus, because there were relatively fewer wildland compared to non-wildland firefighters in our sample, we tested for homogeneity of variance utilizing the Levene's test (Levene, 1960). The null hypothesis for the Levene's test is that the error variance of the dependent variable is equal across groups; thus, a non-significant Levene's test suggests that the homogeneity of variance assumption is met and ANCOVA findings are interpretable, even in the context of unequal between-group sample sizes. A linear regression model was utilized to determine the association of wildland firefighter status and SBQ-R suicide risk. Consistent with guidelines recommended by Hayes (2013), bootstrap mediation analyses with 5,000 repetitions were conducted to test the hypothesis that the parallel indirect effects of both INQ-TB thwarted belongingness and INQ-PB perceived burdensomeness would significantly account for the relationship between wildland firefighter status and SBQ-R suicide risk. A 95% bias-corrected confidence interval (CI) that did not cross zero indicated a statistically significant effect. The PROCESS macro (Model 4) within SPSS was utilized for mediation analyses (Hayes, 2013). As noted, female firefighters are oversampled in the current study and a descriptively greater proportion of wildland firefighters were female; thus, we controlled for sex across analyses. Data on sex were missing for two participants in the non-wildland firefighter group; listwise deletion was utilized.

3. Results

First, variables were screened for violations of normality; all predictor variables were within acceptable ranges (i.e., $< |3|$ for skewness and kurtosis). Variance inflation factors (VIFs) were also within the acceptable range (all VIFs < 2), indicating that multicollinearity was not a problem. Please see Table 2 for study variable means, standard deviations, normality statistics, and intercorrelations. Please see Table 3 for item-level SBQ-R descriptive information.

Next, we conducted the Levene's test to determine if the assumption of homogeneity of variance was met for our ANCOVA analyses. Indeed, the assumption was met for the INQ-PB ($F[1,1127] = 0.562$, $p = 0.454$), INQ-TB ($F[1,1127] = 0.372$, $p = 0.542$), and SBQ-R ($F[1,1127] = 2.124$, $p = 0.145$) total scores in models controlling for sex. Thus, an ANCOVA is an appropriate statistical test to use with our data. Wildland firefighters reported significantly higher mean levels of SBQ-R suicide risk compared to non-wildland firefighters ($M[SD] = 7.40[3.99]$ vs. $5.78[3.00]$), even after accounting for the effect of sex ($F[1,1127] = 5.670$, $p = 0.017$). The mean SBQ-R score for wildland firefighters exceeded the clinical cutoff score established for non-psychiatric samples (i.e., 7; Osman et al., 2001). Put another way, 55.0% of wildland firefighters exceeded the SBQ-R clinical cutoff compared to 32.04% of non-wildland firefighters, representing a statistically significant difference ($\chi^2 = 4.724$, $p = 0.030$). Wildland

Table 2
Study variable means, standard deviations, and intercorrelations.

| Variable | 1 | 2 | 3 | 4 | 5 | <i>M</i> | <i>SD</i> | Range | Skewness | Kurtosis |
|------------------------------------|--------|---------|----------|-------|---|----------|-----------|-------|----------|----------|
| 1. Wildland firefighter | – | | | | | – | – | – | – | – |
| 2. INQ-TB Thwarted belongingness | 0.068* | – | | | | 24.38 | 12.55 | 9–62 | 0.529 | –0.702 |
| 3. INQ-PB Perceived burdensomeness | 0.030 | 0.527** | – | | | 10.07 | 7.62 | 6–42 | 1.992 | 2.874 |
| 4. SBQ-R Suicide risk | 0.070* | 0.565** | 0.716** | – | | 5.81 | 3.03 | 3–18 | 0.999 | 0.129 |
| 5. Sex (Male) | 0.053 | 0.065* | –0.093** | 0.006 | – | – | – | – | – | – |

Note. * $p < 0.05$, ** $p < 0.01$. Wildland firefighter: 1 = Yes, 0 = No. Male; SBQ-R = Suicidal behaviors questionnaire—revised.

Table 3
Item level examination of the Suicidal Behaviors Questionnaire—Revised¹.

| Variable | Full sample (N = 1,131) | Wildland firefighters (n = 20) | Non-wildland firefighters (n = 1,111) |
|---|----------------------------|--------------------------------------|---|
| 1. "Have you ever thought about or attempted to kill yourself?", n (Valid %) | | | |
| Never | 459 (40.6%) | 4 (20.0%) | 455 (41.0%) |
| Brief, passing thought | 383 (33.9%) | 8 (40.0%) | 375 (33.8%) |
| Past suicide plan ² | 242 (21.4%) | 5 (25.0%) | 237 (21.3%) |
| Past suicide attempt ² | 47 (4.2%) | 3 (15.0%) | 44 (4.0%) |
| 2. "How often have you thought about killing yourself in the past year?", n (Valid %) | | | |
| Never | 668 (59.1%) | 7 (35.0%) | 661 (59.5%) |
| Rarely (1 time) | 201 (17.8%) | 5 (25.0%) | 196 (17.6%) |
| Sometimes (2 times) | 190 (16.8%) | 5 (25.0%) | 185 (16.7%) |
| Often (3–4 times) | 48 (4.2%) | 2 (10.0%) | 46 (4.1%) |
| Very often (5 or more times) | 24 (2.1%) | 1 (5.0%) | 23 (2.1%) |
| 3. "Have you ever told someone that you were going to commit suicide, or that you might do it?", n (Valid %) | | | |
| No | 883 (78.1%) | 13 (65.0%) | 870 (78.3%) |
| Yes, once ² | 178 (15.7%) | 5 (25.0%) | 173 (15.6%) |
| Yes, more than once ² | 70 (6.2%) | 2 (10.0%) | 68 (6.1%) |
| 4. "How likely is it that you will attempt suicide someday?", n (Valid %) | | | |
| Never | 582 (51.5%) | 8 (40.0%) | 574 (51.7%) |
| No chance at all | 209 (18.5%) | 4 (20.0%) | 205 (18.5%) |
| Rather unlikely | 229 (20.2%) | 4 (20.0%) | 225 (20.3%) |
| Unlikely | 87 (7.7%) | 3 (15.0%) | 84 (7.6%) |
| Likely | 18 (1.6%) | 0 (0.0%) | 18 (1.6%) |
| Rather likely | 4 (0.4%) | 0 (0.0%) | 4 (0.4%) |
| Very likely | 2 (0.2%) | 1 (5.0%) | 1 (0.1%) |
| Total Score, Mean (SD) | 5.81 (3.03) | 7.40 (3.99) | 5.78 (3.00) |

Note. * $p < 0.05$, ** $p < 0.01$. SBQ-R = Suicidal Behaviors Questionnaire—Revised.
¹Osman et al. (2001). ²For these categories, more than one answer choice is presented to participants; per the scoring guidelines outlined in Osman et al. (2001), the responses are collapsed for scoring purposes.

firefighters also reported significantly higher mean levels of INQ-TB thwarted belongingness ($M[SD] = 30.75[11.77]$ vs. $24.26[12.54]$; $F[1,1127] = 4.817$, $p = 0.028$), but not INQ-PB perceived burdensomeness ($M[SD] = 11.75[8.22]$ vs. $10.04[7.61]$; $F[1,1127] = 1.384$, $p = 0.240$), in analyses controlling for sex.

Wildland firefighter status was associated with higher SBQ-R suicide risk scores, controlling for sex ($B = 1.625$, $SE = 0.682$, $p = 0.017$); sex was not a statistically significant correlate of suicide risk in this model ($B = 0.013$, $SE = 0.193$, $p = 0.948$). Regarding the bootstrap mediation analyses examining the parallel indirect effects of both INQ-TB thwarted belongingness and INQ-PB perceived burdensomeness on the association between wildland firefighter status and SBQ-R suicide risk, controlling for sex, the overall model explained a significant portion of the variance in SBQ-R suicide risk ($R^2 = 56.27$, $F[4, 1124] = 361.652$, $p < 0.001$). In this model, the direct effects of wildland firefighter status on SBQ-R suicide risk scores, controlling for INQ-TB thwarted belongingness, INQ-PB perceived burdensomeness and sex, approached statistical significance ($B = 0.780$, $SE = 0.454$, $p = 0.086$). Moreover, in this model, INQ-TB thwarted belongingness ($B = 0.061$, $SE = 0.006$, $p < 0.001$), INQ-PB perceived burdensomeness ($B = 0.233$, $SE = 0.009$, $p < 0.001$), and female sex ($B = 0.274$, $SE = 0.130$, $p = 0.036$) were each associated with increased SBQ-R suicide risk. The total indirect effect was non-significant (95% CI = -0.0731 , 1.9233). The specific indirect effect of INQ-TB thwarted belongingness (95% CI = 0.0477 , 0.7183), but not INQ-PB perceived burdensomeness (95% CI = -0.2539 , 1.4024), on SBQ-R suicide risk was statistically significant. The pattern of findings was the same when examining INQ-TB and INQ-PB as mediators of the association between wildland firefighter status and suicide risk in separate models, with INQ-TB (95%

CI = 0.1232 , 1.5352), but not INQ-PB (95% CI = -0.3384 , 1.7397), serving as statistically significant mediators.¹

4. Discussion

The present study sought to empirically examine if wildland firefighters are at elevated suicide risk compared to their non-wildland firefighter counterparts. Moreover, this study sought to determine if two constructs from the interpersonal theory of suicide—thwarted belongingness and perceived burdensomeness—statistically accounted for the association between wildland firefighter status and suicide risk. Findings were consistent with previously published anecdotal reports that wildland firefighters represent a fire service subgroup that may be at increased suicide risk (Gabbert, 2017; Hansman, 2017; Keller, 2017). Importantly, this study also identified thwarted belongingness (but not perceived burdensomeness) as a potential explanatory factor in the increased suicide risk observed in this population.

Of note, thwarted belongingness is a construct that reflects perceptions of having few friends and being disconnected from others (Van Orden et al., 2010). While previous research has suggested that firefighters experience lower levels of thwarted belongingness, in part due to the camaraderie inherent within fire departments (Chu et al., 2016), the present study has identified that *within the fire service*, wildland firefighters report relatively higher levels of thwarted belongingness. One possible explanation is that, in many instances, wildland firefighter crews are built on demand (i.e., from a registry of available firefighters when the need arises). Although trust and teamwork may build quickly, it is plausible that these *ad hoc* crews do not provide a comparable level of support to longstanding crews within individual fire departments. If such deep bonds do initially form, our findings suggest that these deep bonds might be powerfully offset by other factors, such as how fleeting they might be, how pulled away wildland firefighters might feel from their family and friends, and so on. In some ways, wildland firefighter crews resemble in structure the National Guard and Reserves of the U.S. Armed Forces (i.e., an *ad hoc* composition). Interestingly, the suicide rate among National Guard is elevated within the military (Pruitt et al., 2017), converging with the patterns found in the present study among wildland firefighters with regard to suicide risk. Compounding this, as noted, wildland firefighters often spend protracted time away from home, possibly contributing to increases in perceptions of thwarted belongingness.

Nevertheless, that thwarted belongingness serves as a potential explanatory factor for why wildland firefighters might be at relatively increased risk compared to their non-wildland firefighter colleagues has notable clinical implications. Several leading firefighter organizations, such as the International Association of Fire Fighters (IAFF, 2017), advocate for the use of peer support programs as one avenue to reduce suicide risk. Given that wildland firefighters, by virtue of their extended deployments away from family and friends, might experience increased levels of thwarted belongingness, it might be important for psychoeducation and/or peer support programs to be bolstered for this portion of the fire service (cf. Stanley et al., 2018). Findings from the current study, as well as the premise of peer support programs, would suggest that increasing social connectedness would, in turn, reduce suicide risk (cf. Joiner et al., 2009). The degree to which peer support programs reduce suicide risk among firefighters, including wildland firefighters, is an empirical question deserving of empirical inquiry (Henderson et al., 2016). Peripheral evidence utilizing non-firefighter

¹ Because this was a web-based study for which financial compensation was offered to participants, we took several safeguards to ensure data integrity. One safeguard was the empirical construction of an index reflecting the degree of confidence we had that each participant reflected a unique, non-redundant response (on a scale of 0–1, with 1 being 100% confident). We constructed additional models consistent with those presented herein that additionally controlled for this index. Importantly, the pattern of findings remained unchanged, strengthening our confidence in the validity of the data obtained.

samples suggests that interventions that seek to increase social connectedness demonstrably reduce suicide risk (Motto and Bostrom, 2001; Reger et al., 2017).

4.1. Limitations and future directions

The present investigation has several limitations. This study was a secondary data analysis of two existing firefighter samples for which wildland firefighters were not selectively recruited. Future research may benefit from targeted recruitment efforts, given that wildland firefighters comprise a relatively smaller proportion of the overall fire service and larger samples are needed to derive more externally valid estimates; an alternative explanation is that our study recruited more connected wildland firefighters (otherwise they may not have been as likely to have participated in our study) and, if so, we found elevated suicide risk via social disconnectedness despite studying relatively well-connected wildland firefighters. Further, the data were cross-sectional, precluding inferences regarding the temporality between wildland firefighter status, social disconnectedness, and suicide risk. Relatedly, we were unable to test nuanced predictions of the interpersonal theory of suicide, including examining perceived hopelessness about the tractability of thwarted belongingness and perceived burdensomeness (see Van orden et al., 2010) because these variables were not collected. Indeed, a recent meta-analysis of the theory highlighted that this is an understudied area of research (Chu et al., 2017).

Data were also lacking regarding wildland firefighter status (e.g., full-time, part-time, seasonal) as well as the scope of wildfire deployments, including occupational exposures and time spent away from non-firefighter family/friends. Finally, and importantly, only a small portion (1.8%, $n = 20$) of our combined sample identified as wildland firefighters. The relatively small sample of one subgroup presented at least two challenges. First, we were underpowered to detect statistically significant differences in mean scores between groups (Faul et al., 2009). We were also underpowered to detect significant mediated effects due to the unbalanced sample sizes (Frazier et al., 2004). Despite this, we still detected significant between-group differences for INQ-TB thwarted belongingness and SBQ-R suicide risk, as well as a significant mediated effect of INQ-TB thwarted belongingness. However, the non-significant between-group and mediated finding for INQ-PB perceived burdensomeness may be due to lack of statistical power. Second, the small subgroup of wildland firefighters reduces external validity (i.e., generalizability); however, the imbalance in wildland firefighters and non-wildland firefighters observed in this sample is consistent with what would be expected given the larger fire service demographic composition, arguing in favor of representativeness. Importantly, future research is needed to replicate these findings among samples with a larger proportion of wildland firefighters using a more comprehensive assessment, ideally within a longitudinal design, to quantify the degree to which wildland firefighter duties might impact levels of social disconnectedness and suicide risk.

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