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Distress Overtolerance and Suicide Risk in Firefighters: Incremental and Longitudinal Associations

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Abstract

Firefighters experience elevated suicide risk; however, factors influencing this risk remain understudied among this frontline population. Distress overtolerance (DO), or enduring high emotional distress, may represent a novel risk factor in the fire service, where occupational norms reinforce persistence under stress. The present study examined whether DO subfactors (Capacity for Harm [CH]: persisting through distress despite harm to one's well-being; Fear of Negative Evaluation [FNE]: persisting through distress to avoid negative judgment) predicted variance in suicidal ideation and suicide risk. Firefighters (N = 79) were recruited from a U.S.-based national first responder service agency and completed self-report measures at baseline and follow-up as part of a larger study of mental health among first responders during the COVID-19 pandemic. Hierarchical regression models using baseline data indicated that CH accounted for significant variance in suicidal ideation (ΔR^2 = 0.13) and suicide risk (ΔR^2 = 0.16), while FNE accounted for variance only in suicide risk (ΔR^2 = 0.07). Longitudinal models indicated that both CH and FNE were significantly and preliminarily associated with suicide risk, but only CH was significantly associated with suicidal ideation. Findings suggest that DO may represent a clinically meaningful suicide risk factor in firefighters, with implications for assessment and prevention efforts.

Keywords: distress tolerance; distress overtolerance; suicidal ideation; suicidal behaviors; suicide risk; firefighters; first responders

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1. Introduction

Firefighters are frequently exposed to potentially traumatic events in the line of duty, e.g., wild and urban fires, car accidents, responding to suicide, natural disasters [1], placing them at elevated risk of developing trauma-related behavioral health challenges. Suicidal ideation and suicide risk are of particular concern given the alarmingly high rates found among firefighters relative to other populations [2,3]. Unique occupational factors in the fire service may exacerbate suicide risk, such as sleep disturbances due to shift work [4], stigma associated with seeking behavioral health support [5], specific organizational stressors (e.g., low morale, financial strain, work–life interference, and poor mental

health outcomes) [6], number of years as a first responder [3], and an overall lack of access to specialized behavioral health services [7]. In addition to these occupational stressors, firefighters often experience other, particularly salient behavioral health challenges, such as posttraumatic stress disorder (PTSD), which has been consistently linked to elevated suicide risk through factors such as heightened emotional distress, avoidance-based coping, and impaired interpersonal functioning [8,9]. Thus, suicide prevention among firefighters is a critical priority, and identifying the psychological mechanisms underlying this risk is essential to supporting operational readiness and behavioral health care among this frontline population.

One factor that may be particularly relevant to suicide risk is distress tolerance (DT). Extant research among firefighters has examined DT, the capacity to withstand negative physical or affective states [10] and its inverse associations with PTSD and suicidality [11–13], meaning high DT is related to better psychological functioning (and vice versa). However, some empirical work has demonstrated that extremely high levels of DT may potentially be maladaptive and harmful. For instance, high levels of DT have been associated with non-suicidal self-injury [14,15] and more severe suicidal behaviors in various conditions, such as borderline personality disorder [16] and PTSD [17]. These findings point to the need for additional research on how over-tolerating distress may relate to suicide risk.

Distress overtolerance (DO), the tendency to persist through intense distress despite the negative impact on the individual's wellbeing [18,19], represents a relatively novel construct that is related to but distinct from DT. Indeed, scores on measures of DT and DO have been found to be inversely and moderately correlated [18,20], suggesting that these are distinct constructs. DO has been conceptualized with two subfactors: Capacity for Harm (CH), enduring distress despite the harm to one's well-being, and Fear of Negative Evaluation (FNE), persisting to avoid anticipated social judgement upon quitting [18]. The extant literature examining DO is still in its infancy [14,21,22], particularly among firefighters [23]. This gap is notable, as DO may be uniquely associated with suicide risk in this population and may not only help explain such risk, but also represent a clinically meaningful intervention target.

Fire service culture and training emphasize physical and mental fortitude, promoting themes of toughness, "grit", and emotional control and self-reliance [24,25]. Fire service training also fosters a tolerance of job-related physical distress (e.g., carrying heavy equipment, familiarity with a breathing apparatus) [26,27]. While these traits may be conducive to on-scene job performance, they can also reinforce stigma around help-seeking, particularly through concerns about showing "weakness" and being perceived as unfit for duty. Thus, firefighter cultural norms and training outcomes may reinforce DO (i.e., persistence while suffering in silence). Unfortunately, and aligned with established suicide risk theory (e.g., interpersonal therapy of suicide) [28], a lack of help-seeking and maladaptive persistence through distress (i.e., DO) may, in turn, contribute to prolonged psychological suffering and a potentially increased risk of suicide for firefighters. However, despite its theoretical relevance, DO has received little empirical attention in the general population, particularly in relation to suicide risk. To date, no studies have directly explored the associations between DO and suicide risk among firefighters.

The present study sought to examine DO as a novel and underrecognized, clinically relevant risk factor for suicide and suicidal ideation among firefighters. Specifically, we investigated whether DO subfactors (i.e., CH and FNE) were associated with suicidal ideation and suicide risk and whether they explained incremental variance beyond established theoretically relevant risk factors, including trauma load (i.e., total number of traumatic event types endorsed) [29], number of years as a first responder [3], and PTSD symptom severity [2]. We hypothesized that both CH and FNE would be positively asso-

ciated with suicidal ideation and suicide risk and that they would account for additional variance in suicide outcomes above and beyond relevant risk factors. Given the limited empirical work on DO within firefighter samples, we also conducted preliminary longitudinal analyses to examine whether baseline DO was prospectively associated with trajectories of suicidal ideation and suicide risk at 2-week and 1-month follow-up. We hypothesized that higher baseline DO would be associated with greater suicidal ideation and suicide risk over time and would predict steeper increases in suicidal ideation and suicide risk. Taken together, this study aimed to evaluate DO as a distinct and potentially modifiable risk factor for suicidal ideation and suicide risk among a sample of first responders recruited through a national first responder service agency.

2. Materials and Methods

2.1. Participants

The current sample included 79 firefighters (M_{age} = 44.4, *SD* = 10.2; 86% male) selected from a larger longitudinal study examining the behavioral health outcomes of first responders during the COVID-19 pandemic [30]. The parent study (*N* = 88) included a range of first responder roles, including firefighters (with or without emergency medical service [EMS] or paramedic duties; *n* = 76), EMS personnel and paramedics in non-firefighter roles (*n* = 7), dual firefighter and law enforcement personnel (*n* = 3), law enforcement officers (*n* = 1), and emergency dispatchers (*n* = 1). Given the composition of the overall sample, which was predominantly firefighters (90%), the present analysis was restricted to firefighters, including those serving in fire suppression (*n* = 24), EMS or paramedic roles (*n* = 52), and/or law enforcement roles (*n* = 3), to facilitate generalization of study findings to other firefighter populations, resulting in a sample of 79 firefighters. Most participants were paid (96%), worked in urban departments (71%), and were recruited from the southern United States (90%). Information regarding wildland versus structural firefighting assignments was not collected as part of the parent study. Inclusion criteria for the parent study required participants to be 18 years of age or older, currently working as a first responder in a career or volunteer capacity, and able to provide informed consent to complete an online survey. Exclusion criteria included individuals who were unable or unwilling to provide consent.

2.2. Measures

Demographic and Medical Questionnaire. A 41-item self-report measure was used to collect sociodemographic data (e.g., gender, age, first responder role and years of service), medical history, and psychological treatment history. Years as a first responder was included as a covariate in the current analyses.

Distress Overtolerance Scale (DOS) [18]. The DOS is a 16-item self-report measure designed to assess the extent to which individuals continue tolerating distress even when doing so negatively affects their well-being. Items on the DOS are rated on a 6-point scale (1 = *completely untrue of me* to 6 = *completely true of me*), with higher scores indicating higher levels of distress overtolerance (range = 0–96). The DOS comprises two subscales: Capacity for Harm (i.e., CH), which assesses the tendency to persist through distress despite harm to one's well-being, as well as Fear of Negative Evaluation (i.e., FNE), which assesses the tendency to persist through distress to avoid negative judgment from others. The DOS has demonstrated strong psychometric properties [18]. The internal consistency of the DOS CH score was excellent (α = 0.94) and the DOS FNE score was good (α = 0.85). Both the CH and FNE subscales of the DOS were included as predictor variables in the current study.

Beck Scale for Suicide Ideation-5 (BSS-5) [31]. The BSS-5 is a 5-item self-report measure derived from the full-length version of the BSS, which assesses the severity of current suicidal ideation over the past week. The assessment timeframe was modified at follow-up

assessments to correspond with the study assessment schedule and minimize overlap in reporting periods to better capture ideation since the previous survey. Items are summed to produce a total score that ranges from 0 to 10, where higher total scores indicate more severe suicide ideation. The BSS has demonstrated strong psychometric properties in past work [32,33]; however, internal consistency of the BSS-5 varied across timepoints (baseline α = 0.61; 2-week α = 0.98; 1-month α = 0.88), with baseline estimates falling below those reported in prior firefighter samples, e.g., [34]. The total score of the BSS-5 was used as a primary outcome variable in the current study.

Suicide Behaviors Questionnaire-Revised (SBQ-R) [35]. The SBQ-R is a brief, self-report questionnaire (4-items) designed to capture multiple indicators of suicide risk, including prior suicidal behavior, recent suicidal ideation, disclosure of suicidal intent, and perceived likelihood of future suicidal behavior over the past 12 months. In contrast to the BSS-5, which focuses specifically on current suicidal ideation, the SBQ-R captures a broader range of factors associated with suicide risk. The assessment timeframe was adjusted at follow-up assessments to correspond with the study assessment schedule and minimize overlap in reporting periods. Higher scores on the SBQ-R (range = 3–18) indicate greater levels of suicide risk. The SBQ-R has demonstrated excellent psychometric properties [36] and its internal consistency was good across timepoints (baseline α = 0.84; 2-week α = 0.85; 1-month α = 0.85). The SBQ-R total score was evaluated as a primary outcome variable in the current study.

Life Events Checklist for DSM-5 (LEC-5) [37]. The LEC-5 is a self-report checklist designed to capture exposure to specific traumatic events experienced throughout a person's life. The measure includes 16 categories of potentially traumatic events (e.g., fire, physical assault, vehicle accident, natural disaster) and an additional item assessing exposure to other traumatic events not otherwise represented. For the purposes of the current study, participants were considered exposed to a traumatic event type if they indicated that it directly happened to them, that they witnessed it, or that it occurred as part of their occupational duties. A cumulative trauma load score was calculated by summing the total number of traumatic event types endorsed. Trauma load was used as a covariate in study analyses and was assessed only during the baseline assessment.

PTSD Checklist for DSM-5 (PCL-5) [38]. The PCL-5 is a self-report checklist (20-items) used to assess the severity of past-month PTSD symptoms, each corresponding to criteria described in the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5)* [39] for PTSD. Participants completed the measure with respect to the traumatic event identified as the most distressing on the baseline LEC-5. Items are rated on a 5-point scale from 0 (*Not at all*) to 4 (*Extremely*), with higher total scores (range = 0–80) reflecting greater symptom severity during the past month. Prior research has supported the reliability and validity of the PCL-5 [38] and its internal consistency at baseline was excellent (α = 0.96). The baseline PCL-5 total score was used as a covariate in the current analyses.

2.3. Procedure

Study participants were recruited through a U.S.-based national first responder service agency email distribution list, as well as locally from fire departments in the southern U.S. via departmental listservs. Current members/personnel received study-related information and hyperlinks to an electronic consent form and survey via email. The study invitation described a project examining behavioral health among first responders during the COVID-19 pandemic. The invitation noted an estimated survey completion time of 15 to 20 min and offered entry into a drawing for a $50 electronic gift card as an incentive for participation. After providing electronic consent, participants were directed to a secure online survey via Qualtrics and completed eligibility screening questions (i.e., current first

responder employment and age). Participants who met inclusion criteria proceeded to the baseline survey and were subsequently invited to complete assessments at 2-week and 1-month follow-up. Follow-up assessments were adapted at follow-up to reflect experiences occurring since the prior assessment in order to minimize overlap in reporting periods. Participants were advised that participation was entirely voluntary and that they could withdraw from the study at any point without consequence. All study procedures received approval from the appropriate institutional review board(s).

2.4. Data Analytic Plan

All analyses were conducted in IBM SPSS Statistics (version 30.0). First, data were evaluated for normality, multicollinearity, and missingness. The data demonstrated acceptable normality and there was no evidence of multicollinearity, as indicated by acceptable variance inflation factors (<3) and tolerance values (>0.40). Approximately 9% of PTSD symptom severity (PCL-5) data were missing at baseline; however, data were determined to be missing completely at random (MCAR), as indicated by a non-significant Little's MCAR test ($p = 0.999$). Missing data were handled using listwise deletion for regression analyses. For longitudinal mixed-effects modeling, all participants in the current sample at baseline ($N = 79$) were included in analyses, consistent with an intent-to-treat approach. Follow-up completion rates were 38 participants at 2 weeks (48%) and 29 participants (37%) at 1-month follow-up and missing data were handled using restricted maximum-likelihood (REML) estimation, allowing inclusion of all available data under the assumption of missing at random (MAR). Baseline characteristics were compared between participants who completed all assessments and those who completed only the baseline assessment to evaluate potential attrition bias. Participants who completed all three assessments reported statistically significantly greater trauma load at baseline than participants who completed only the baseline assessment; however, no differences emerged for DO subfactors, PTSD symptom severity, suicidal ideation, suicide risk, and years as a first responder, or other study variables.

Second, descriptive statistics (see Table 1) and bivariate correlations (see Table 2) were conducted for all study variables. Third, a series of hierarchical linear regression analyses (see Table 3) were conducted to examine whether DOS subscales (CH and FNE) accounted for unique variance in suicidal ideation (BSS-5) and suicide risk (SBQ-R). At step one, years as a first responder and trauma load (LEC-5) were entered as covariates. Covariates were selected a priori based on theoretical and empirical associations with suicide risk among firefighters and first responders. At step two, PTSD symptom severity (PCL-5) was entered. At step three, separate hierarchical regression models were estimated for each DOS subscale. Specifically, CH and FNE were entered individually following the inclusion of covariates and PTSD symptom severity, allowing for evaluation of the incremental variance explained by each DO subfactor in separate models.

Finally, preliminary longitudinal analyses were conducted using linear mixed-effects models to examine whether baseline CH and FNE were prospectively associated with overall levels of suicidal ideation and suicide risk, as well as changes in these outcomes over time. Time (baseline, 2-week, and 1-month follow-up) was modeled as a continuous variable, and random intercepts were included to account for repeated observations nested within individuals. Fixed effects included time and baseline CH and FNE as well as the interaction between time and DO subfactors. Significant interactions between time and DO subfactors were interpreted as evidence that changes in suicide-related outcomes differed as a function of baseline CH or FNE. Models were conducted separately for suicidal ideation and suicide risk.

Table 1. Sample characteristics (N = 79).

Variable	Mean (*SD*)/*n* (%)
Sex assigned at birth [a]	
Male	68 (86.1%)
Female	11 (13.9%)
Race [a]	
White	65 (82.3%)
Black/African American	5 (6.3%)
Other	7 (8.9%)
American Indian or Alaskan Native	1 (1.3%)
Asian	1 (1.3%)
Ethnicity [a]	
Hispanic/Latino	11 (13.9%)
Non-Hispanic/Latino	68 (86.1%)
Age [a]	44.44 (10.18)
Education [a]	
High school	3 (3.8%)
Some college	27 (34.2%)
College graduate	49 (62.0%)
Relationship status [a]	
Married	54 (68.4%)
Single	10 (12.7%)
Living with a partner	4 (5.1%)
Divorced	10 (12.7%)
Widowed	1 (1.3%)
Armed service history (yes) [a]	14 (17.7%)
First responder role [a]	
Firefighter	24 (30.4%)
Firefighter with EMS duties	52 (65.8%)
Dual firefighter and law enforcement officer	3 (3.8%)
Career (i.e., paid) position [a]	76 (96.2%)
Occupational setting [a]	
Urban	56 (70.9%)
Suburban	17 (21.5%)
Rural	6 (7.6%)
U.S. region [a]	
Northeast	2 (2.5%)
Midwest	3 (3.8%)
West	3 (3.8%)
South	71 (89.9%)
Probable PTSD [b]	5 (6.3%)

Note.[a] Demographic and Medical Questionnaire; [b] PTSD Checklist for *DSM-5* score > 33.

Table 2. Descriptive statistics and bivariate correlations between study variables.

	1	2	3	4	5	6	7	8
1. Years of fire service [a]	-							
2. Trauma load [b]	0.01	-						
3. PTSD symptom severity [c]	−0.18	0.17	-					
4. Distress overtolerance [d]	−0.01	0.11	0.58 **	-				
5. Capacity for harm [d]	−0.01	0.12	0.60 **	0.97 **	-			
6. Fear of negative evaluation [d]	−0.01	0.06	0.42 **	0.87 **	0.73 **	-		
7. Suicidal ideation [e]	−0.08	0.08	0.27 *	0.40 **	0.43 **	0.27 *	-	
8. Suicide risk [f]	−0.12	0.002	0.18	0.43 **	0.45 **	0.30 **	0.66 **	-

Table 2. *Cont.*

	1	2	3	4	5	6	7	8
Mean	17.7	12.8	10.8	45.6	27.1	18.5	0.32	4.3
SD	10.2	2.7	14.4	18.4	13.2	6.5	0.86	2.3
Range	1–44	4–16	0–80	16–96	11–66	5–30	0–5	3–14

Note. Values above are Pearson correlation coefficients (*r*), * $p < 0.05$, ** $p < 0.01$, $N = 79$; PTSD = posttraumatic stress disorder; *SD* = standard deviation; [a] Demographic and Medical Questionnaire; [b] Life Events Checklist for *DSM-5* total number of event types endorsed; [c] PTSD Checklist for *DSM-5* total score; [d] Distress Overtolerance Scale (DOS) total score, DOS Capacity for harm subscale score, DOS Fear of negative evaluation subscale score; [e] Beck Scale for Suicide Ideation-5 total score; [f] Suicide Behaviors Questionnaire-Revised total score.

Table 3. Hierarchical linear regressions examining predictors of suicidal ideation and suicide risk.

Variable	$R^2/\Delta R^2$	β	*t*	sr^2	*p*
	Suicidal ideation				
Step 1	0.015				0.598
Years as a first responder		−0.09	−0.76	0.01	0.452
Trauma load		0.07	0.07	0.01	0.541
Step 2					
PTSD symptom severity	0.06	0.25	2.11	0.06	0.039
Step 3 *					
Capacity for harm	0.131	0.45	3.33	0.131	0.001
Fear of negative evaluation	0.035	0.21	1.62	0.04	0.110
Variable	$\Delta R^2/\Delta R^2$	β	*t*	sr^2	*p*
	Suicide Risk				
Step 1	0.032				0.323
Years as a first responder		−0.17	−1.45	0.03	0.152
Trauma load		−0.07	−0.56	0.00	0.579
Step 2					
PTSD symptom severity	0.028	0.17	1.43	0.03	0.156
Step 3 *					
Capacity for harm	0.163	0.51	3.75	0.16	<0.001
Fear of negative evaluation	0.072	0.30	2.36	0.07	0.021

Note. $N = 79$. * Capacity for Harm and Fear of Negative Evaluation were evaluated in separate hierarchical regression models. Reported ΔR^2 values reflect the incremental variance explained at each step of the model. All variables included in the hierarchical regression models were assessed at baseline. β = standardized beta weight; PTSD = posttraumatic stress disorder; Years as a first responder, derived from the Demographic and Medical Questionnaire; Trauma load = Life Events Checklist for *DSM-5* total number of event types endorsed; PTSD symptom severity = PTSD Checklist for *DSM-5* total score; Capacity for harm = Distress Overtolerance Scale (DOS) Capacity for Harm subscale score, Fear of negative evaluation = DOS Fear of negative evaluation subscale score; Suicidal ideation = Beck Scale for Suicide Ideation-5 total score; Suicide Risk = Suicide Behaviors Questionnaire-Revised total score.

3. Results

3.1. Descriptive Statistics and Bivariate Correlations

Participant and study variable characteristics are reported in Table 1, and Pearson bivariate correlation coefficients (*r*) among study variables are provided in Table 2. Participants reported an average of 17.7 years (*SD* = 10.1) serving as a first responder and endorsed 12.8 (*SD* = 2.7) traumatic event types. Approximately 6.9% of the sample with completed PCL-5 data ($n = 72$) met probable PTSD diagnostic criteria (recommended cutoff score of 33) [40]. Regarding bivariate correlation outcomes, years as a first responder was not significantly correlated with any study variables. Trauma load was not significantly associated with any variables. PTSD symptom severity was positively and significantly associated with DO, CH, FNE, and suicidal ideation, but was not significantly associated with suicide risk. DO was strongly and positively correlated with CH and FNE and was

also positively associated with both suicidal ideation and suicide risk. CH and FNE were each positively associated with suicidal ideation and suicide risk. Finally, suicidal ideation and suicide risk were strongly and positively correlated.

3.2. Hierarchical Linear Regression Outcomes

Outcomes from hierarchical regression analyses are provided in Table 3. Regarding suicidal ideation as the outcome variable, covariates in Step 1, years as a first responder ($B = -0.01$, 95% CI [−0.03, 0.01], $\beta = -0.09$; $p = 0.452$) and trauma load ($B = 0.03$, 95% CI [−0.06, 0.11], $\beta = 0.07$; $p = 0.541$) accounted for a non-significant 1.5% of variance ($p = 0.598$). Step 2, which added PTSD symptom severity, accounted for a significant 6.0% of additional unique variance ($B = 0.02$, 95% CI [0.001, 0.03], $\beta = 0.25$; $p = 0.039$). At Step 3, the inclusion of CH accounted for a significant 13.1% of additional unique variance ($B = 0.03$, 95% confidence interval [CI; 0.01, 0.05], $\beta = 0.45$; $p = 0.001$), reflecting a moderate positive association with suicidal ideation, and the inclusion of FNE did not account for a significant increment in variance (3.5%, $B = 0.03$, 95% CI [−0.01, 0.06], $\beta = 0.21$; $p = 0.110$). Regarding suicide risk, covariates in Step 1, years as a first responder ($B = -0.04$, 95% CI [−0.10, 0.02], $\beta = -0.17$; $p = 0.152$) and trauma load ($B = -0.06$, 95% CI [−0.29, 0.16], $\beta = -0.07$; $p = 0.579$) accounted for a non-significant 3.2% of variance ($p = 0.323$). Step 2, which added PTSD symptom severity, accounted for an additional non-significant 2.8% of variance ($p = 0.156$). At Step 3, the inclusion of CH accounted for a significant 16.3% of additional unique variance ($B = 0.09$, 95% CI [0.04, 0.14], $\beta = 0.51$; $p < 0.001$), reflecting a moderate positive association with suicide risk, and the inclusion of FNE accounted for a significant 7.2% of additional unique variance ($B = 0.11$, 95% CI [0.02, 0.20], $\beta = 0.30$; $p = 0.021$), reflecting a comparatively smaller positive association with suicide risk.

3.3. Preliminary Longitudinal Mixed-Effects Model Outcomes

Regarding suicidal ideation, time was not a significant predictor in either the CH model, F[1, 90.84] = 0.56, $p = 0.457$, or the FNE model, F[1, 90.55] = 0.62, $p = 0.435$. Baseline CH was a significant positive predictor of suicidal ideation over time (F[1, 133.34] = 13.87, $p < 0.001$, $B = 0.032$, $SE = 0.008$), while baseline FNE was not a significant predictor (F[1, 138.3] = 3.36, $p = 0.069$). The interactions between time and CH (F[1, 93.89] = 2.23, $p = 0.139$) and FNE (F[1, 90.29] = 0.29, $p = 0.590$) were not significant, indicating that neither DOS subscale was associated with differential change in suicidal ideation over time. Regarding suicide risk, time was not a significant predictor in either the CH model, F[1, 72.01] = 2.78, $p = 0.100$, or the FNE model, F[1, 75.39] = 3.75, $p = 0.057$. Both baseline CH (F[1, 138.73] = 12.21, $p < 0.001$, $B = 0.055$, $SE = 0.016$) and FNE (F[1, 141.86] = 4.61, $p = 0.033$, $B = 0.069$, $SE = 0.032$) emerged as significant positive predictors of suicide risk over time. However, the interactions between time and CH (F[1, 73.18] = 1.12, $p = 0.293$) and FNE (F[1, 74.87] = 0.33, $p = 0.566$) were not significant, indicating that neither DOS subscale was associated with differential change in suicide risk over time.

4. Discussion

The present study sought to examine DO as a novel and clinically relevant risk factor for suicidal ideation and suicide risk among firefighters, with a particular focus on its subfactors, including CH and FNE. Consistent with hypotheses and prior work exploring associations between distress-related constructs and suicidality [11,13], DO subfactors were positively associated with suicidal ideation and suicide risk, especially CH, above and beyond theoretically relevant risk factors, including trauma load, years as a first responder, and PTSD symptom severity. Preliminary longitudinal analyses indicated that baseline CH and FNE were associated with greater suicide risk, while only CH was associated

with suicidal ideation, although findings involving suicidal ideation should be interpreted cautiously given the lower reliability of the BSS-5 at baseline. Overall, these findings highlight DO as a potentially critical and underrecognized factor in understanding suicide risk among firefighters, consistent with emerging conceptualizations of DO [18] and prior work suggesting that excessively high tolerance of distress may be maladaptive [14,15].

Aligned with study hypotheses, CH demonstrated robust associations with both suicidal ideation and suicide risk. Notably, CH accounted for significant incremental variance in both outcomes above and beyond PTSD symptom severity and other risk factors. The addition of CH accounted for 13% to 16% additional variance in suicide-related outcomes and demonstrated moderate associations with suicidal ideation (β = 0.45) and suicide risk (β = 0.51), suggesting that the tendency to persist through distress despite harm to one's well-being may represent a particularly salient risk factor for suicidality among firefighters. These findings extend previous research on DT and DO by supporting the idea that excessively high tolerance of distress may be maladaptive and confer increased risk for self-injurious thoughts and behaviors, e.g., [14,41]. This may be particularly salient for personnel in the fire service, where cultural norms emphasize endurance, toughness, and emotional control, e.g., [24,25]. Importantly, the fact that CH accounted for incremental variance beyond PTSD symptom severity highlights its potential utility as a distinct and clinically meaningful construct, e.g., [23]. At the same time, CH may share conceptual overlap with established suicide-related constructs, including acquired capability for suicide, pain tolerance, emotional suppression, and other forms of maladaptive persistence. However, CH was conceptualized as the tendency to continue enduring distress despite harm to one's well-being, rather than fearlessness about death, elevated pain tolerance, or suppression of emotional experiences [18]. Future research is needed to directly examine the discriminant validity of DO relative to these related constructs and determine whether it provides unique explanatory value beyond existing models of suicide risk.

Conversely, findings regarding FNE were more mixed. Although FNE was associated with suicide risk, it did not emerge as a significant predictor of suicidal ideation, suggesting a more limited role in suicide risk. Given that FNE reflects maladaptive persistence in the context of anticipated social judgment, firefighters high in this construct may be more likely to suppress distress and avoid help-seeking altogether. It is also possible that FNE indirectly contributes to suicide risk, potentially through well-established interpersonal mechanisms, such as perceived burdensomeness or thwarted belongingness, e.g., [28,42], which were not assessed in the current study. For example, persistent concerns about negative evaluation may heighten perceptions of being a burden or socially disconnected, while simultaneously discouraging help-seeking due to fears of stigma or judgment, which may elevate risk of suicide over time. However, it is important to note that the BSS-5 demonstrated poor internal consistency at baseline (α = 0.61), despite good-to-excellent internal consistency at the 2-week (α = 0.98) and 1-month (α = 0.88) follow-up assessments. Although the reasons for this variability are unclear, it may partly reflect the brief nature of the measure, the low base rate of suicidal ideation in the current sample, and differences in participant retention over time. As such, associations involving suicidal ideation may have been attenuated, and the absence of a significant association between FNE and suicidal ideation should be interpreted cautiously. Future research is needed to directly examine these interpersonal mechanisms and their association with FNE, and DO more broadly, to better elucidate suicide risk-related pathways among firefighters.

Interestingly, PTSD symptom severity was not a significant unique predictor of suicide risk in the hierarchical regression models, despite demonstrating significant associations with suicidal ideation. There is a substantial body of work demonstrating strong associations between PTSD symptoms and suicidality in the general population and veterans [43],

as well as among firefighters and other first responder populations [2]. Several factors may have contributed to these findings, including the prevalence of probable PTSD in the current sample, which was relatively low (6.9%) compared to other research [29], potential restriction in the range of PTSD symptom severity, limited statistical power, and the possibility that PTSD symptoms may share variance with DO, potentially diminishing the unique contribution of PTSD symptom severity in multivariable models. Accordingly, future research is needed to replicate these findings in larger firefighter samples with greater variability in PTSD symptom severity.

Findings from the preliminary longitudinal mixed-effects models provided partial support for study hypotheses. Specifically, baseline CH was significantly associated with both suicidal ideation and suicide risk from baseline to 1-month follow-up, while baseline FNE was only significantly associated with suicide risk. These findings, although mixed, are consistent with the cross-sectional results highlighting differential effects between DOS subscales, e.g., [18,23] and further underscore CH as a robust correlate of suicide risk, especially among firefighters considering occupational and cultural norms related to distress management concurrent with high rates of suicidality, e.g., [3]. However, neither CH nor FNE were prospectively associated with differential change in suicidal ideation or risk over time, as demonstrated by non-significant interaction effects with time. It is possible that DO subfactors may be more strongly associated with overall levels of suicide risk rather than trajectories of change over relatively short follow-up periods. Alternatively, the limited duration of follow-up and reduced sample size at later time points may have limited the ability to detect more nuanced longitudinal effects. Nonetheless, this is one of the first studies to examine DO longitudinally; thus, future work is needed to further investigate its role in shaping changes in suicide risk over time, both in the general population as well as in first responders.

4.1. Limitations and Future Directions

Several limitations should be considered when interpreting these findings. First, the current study utilized a relatively small sample size, with reduced participation at follow-up assessments and a short follow-up timeframe, which may have limited the ability to detect more nuanced longitudinal effects, such as changes in suicidal ideation and suicide risk over time. Although completers and non-completers differed only on baseline trauma load, the substantial attrition observed across follow-up assessments further limits confidence in the longitudinal findings, particularly with respect to the interpretation of non-significant interaction effects. Moreover, although common in psychological research, the study measures assessed experiences across different time periods and recall windows, which may have impacted symptom reporting. Second, the sample was restricted to firefighters due to their overwhelming representation in the parent study, which may limit the extent to which these findings apply to other first responder groups (e.g., EMS personnel, law enforcement officers, and dispatchers) that differ in occupational roles, exposure to critical incidents, and access to behavioral health support (e.g., employee assistance programs and peer support teams). Relatedly, the sample was also relatively homogeneous, comprised primarily of White (82%), non-Hispanic (86%), male-identifying (86%), career (96%) firefighters, limiting the generalizability of findings to other firefighter populations as well as volunteers, who represent the majority of the U.S. fire service [44]. Additionally, cultural, organizational, and operational differences across fire service settings may influence the extent to which these findings generalize to firefighters serving in different geographic regions or other occupational contexts (e.g., rural departments). Third, all study variables were assessed using self-report measures among a self-selected sample of first responders who chose to participate, which facilitated data collection but may have also introduced method

variance and self-selection biases. Fourth, although models adjusted for theoretically relevant covariates, residual confounding by demographic and occupational factors not included in the analyses cannot be ruled out. In light of the relatively small sample size and limited variability across participant characteristics, the inclusion of additional covariates would have reduced statistical power and increased the risk of model overfitting. Fifth, trauma load was assessed using the LEC-5, which may function differently in firefighter populations relative to the general population due to the routine occupational exposure to potentially traumatic events. As a result, endorsement of multiple event categories as "part of my job" may have reduced variability in trauma load and limited its utility as a covariate in the present sample. Finally, data were collected during the COVID-19 pandemic, which may have influenced levels of psychological distress and suicide risk considering the frontline role of first responders during that time period, e.g., [30]. Similarly, the pandemic may have also influenced levels of DO, as the extraordinary demands placed on first responders during this period may have reinforced patterns of persisting through distress despite negative consequences.

4.2. Conclusions

Suicidal ideation and suicide risk are a critical concern within the fire service, highlighting the need to identify clinically relevant and potentially modifiable risk factors that contribute to suicide risk in this at-risk population. The present study is among the first to examine DO in relation to suicidal ideation and suicide risk among firefighters and extends this work by evaluating both incremental and longitudinal associations across DO subfactors (i.e., CH and FNE). Study findings demonstrated differential effects across DO subfactors, as both CH and FNE were significantly associated with suicide risk above and beyond established risk factors, but only CH was significantly associated with both suicidal ideation and suicide risk. Importantly, while these findings warrant replication and further investigation, they highlight the potential limits of DT cf. [13], especially in occupational settings where excessively high levels of DT may become maladaptive. Given that DO may represent a malleable and occupationally reinforced construct within the fire service, future research aimed at refining its assessment and developing targeted interventions may help reduce suicide risk and improve behavioral health outcomes among firefighters. Moreover, replication of these findings in larger and more diverse firefighter populations and fire service settings, with more comprehensive assessment of potential confounding factors (e.g., sociodemographic and occupational characteristics), is warranted to support their generalizability.

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