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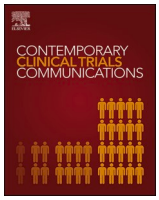

Peer delivered, emotion regulation-focused mental health prevention training for fire fighter trainees: Design and methodology of a randomized controlled trial

Eric C. Meyer [a,*], Todd Farchione [b], Nathan A. Kimbrel [c,d], Oi-Man Kwok [e], Michelle L. Pennington [f], Jessica Rostockyj [f], Suzy B. Gulliver [f,g]

[a] Department of Counseling and Behavioral Health, University of Pittsburgh, Pittsburgh, PA, USA
[b] Department of Psychological and Brain Sciences, Boston University, Boston, MA, USA
[c] Department of Psychiatry, Duke University School of Medicine, Durham, NC, USA
[d] VA Mid-Atlantic Mental Illness Research, Education and Clinical Center, Durham VA Health Care System, USA
[e] Department of Educational Psychology, Texas A&M University, College Station, TX, USA
[f] Warriors Research Institute, Baylor Scott & White Health, Waco, TX, USA
[g] Department of Psychiatry, Baylor College of Medicine, Houston, TX, USA

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ABSTRACT

Fire fighters (FFs) risk their lives, health, and well-being through trauma exposure and other occupational stressors. FFs report concerning rates of mental health challenges, alcohol use disorders, and suicide risk. These problems tend to co-occur, as each is linked with reliance on maladaptive emotion regulation strategies. As FFs advance in their careers, many tend to rely more heavily on these maladaptive emotion regulation strategies, thus exacerbating the problems. Many FFs leave fire service prematurely due to mental and physical health problems. FFs must be equipped with more effective emotion regulation skills to buffer against stressors they will face. FFs may benefit from training in transdiagnostic emotion regulation skills delivered by credible peers upon entry and socialization into the profession, potentially preventing substantial negative outcomes downstream while promoting resilience and wellness. This paper describes a cluster randomized controlled trial to compare peer-delivered emotion regulation training with peer-delivered psychoeducation regarding mental health, both delivered during the fire academy, for preventing symptoms of PTSD (primary outcome), depression, anxiety, alcohol use disorder, and functional impairment. Emotion regulation training is based on the Unified Protocol for Transdiagnostic Treatment of Emotional Disorders. Participants will be a non-clinical population of FF trainees completing the fire academy at 10–12 cities nationwide ($N = 312$). Participants will be cluster randomized to training condition by recruit class. Subsequent recruit classes will then alternate between conditions within each city. Assessment measures will be administered at pre-training baseline, post-training, and at 6-, 12-, 18-, and 24 month follow-ups.
Clinical trial registration: NCT06290778.

1. Introduction

Firefighters (FFs) experience potentially traumatic stressors including exposure to life threatening fires, fatal traffic accidents, line-of-duty deaths, chemical exposures, and terrorist incidents [1]. Routine occupational stressors also predict negative mental health outcomes in FFs [2–6]. Estimated posttraumatic stress disorder (PTSD) rates in FFs range from 5 to 37 % [7–10]. A majority (61 %) of career FFs report problematic alcohol use [10,11]. These rates are substantially higher than in the general population. Depression is as common as in the general population (20 %) despite FFs completing a mental health screening upon entry into the profession [12]. Suicide risk is a major concern among FFs [2,13–15]. Exposure to suicide and suicide behaviors on the job increases risk for suicidal ideation and behavior among

* Corresponding author.
E-mail addresses: ecm77@pitt.edu (E.C. Meyer), tfarchio@bu.edu (T. Farchione), nathan.kimbrel@duke.edu (N.A. Kimbrel), omkwok@tamu.edu (O.-M. Kwok), Michelle.Pennington@bswhealth.org (M.L. Pennington), Jessica.Rostockyj@bswhealth.org (J. Rostockyj), Suzy.Gulliver@bswhealth.org (S.B. Gulliver).

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FFs [13,14,16]. Overall, occupational stressors contribute to early mortality in FFs [17]. Preventing mental health problems would improve FFs' health and wellbeing, thereby improving public safety while reducing costs linked to absenteeism and FFs leaving the workforce prematurely.

Enhanced prevention methods are needed to equip FFs to respond to traumatic and other occupational stressors. This manuscript describes a cluster randomized controlled trial (RCT) funded by the National Institute for Occupational Safety and Health comparing the efficacy of peer-delivered emotion regulation training with peer-delivered mental health psychoeducation for preventing PTSD (primary outcome) and other mental health and functional outcomes (secondary outcomes) in FF trainees. To our knowledge, there has been no fully powered RCT examining prevention of PTSD in FFs or other emergency responders. To maximize transparency and rigor, this manuscript follows the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) guidance for describing clinical trial protocols [18].

1.1. Negative emotionality and emotion regulation: modifiable factors influencing mental health in FFs

Negative emotionality, one of the "Big 3" personality traits [19], reflects how often and intensely individuals experience emotions such as fear, anger, sadness, and guilt and is closely related to the "Big 5" personality trait of neuroticism [19–21]. Negative alterations in cognition and mood are diagnostic criteria for PTSD and are core features of depression, anxiety, and other mental health challenges [21,22]. In longitudinal, observational research with war veterans, negative emotionality predicted PTSD symptom severity over time, even after accounting for the most substantial PTSD risk factors identified in prior meta-analyses and other occupationally relevant risk factors [23–25]. In cross-sectional studies of FFs, negative emotionality was associated with symptoms of PTSD, anxiety, depression, and with occupational burnout [26–28]. In an observational cohort study with FF recruits who did not meet the criteria for any mental health disorder upon study entry, higher pre-employment negative emotionality prospectively predicted and interacted with greater trauma exposure to predict greater clinician-rated PTSD symptom severity over their first three years in fire service [29]. Negative emotionality – and the closely linked personality factor known as neuroticism – is among the most important risk factors in public health based on broad, prospective links with negative health outcomes [30–33]. While traditionally considered a static trait, substantial evidence indicates that negative emotionality is modifiable [34–37].

Emotion regulation refers to both adaptive and maladaptive strategies for managing emotions [38,39]. Maladaptive emotion regulation is linked with greater negative emotionality [40] and symptoms of PTSD, depression, anxiety, and alcohol and substance use disorders [41–43]. In FFs, maladaptive emotion regulation is linked with greater PTSD and other mental health symptom severity and greater likelihood of co-occurrence between PTSD and both AUD and sleep problems [44–47]. Poor emotion regulation mediated the influence of PTSD symptom severity on relationship satisfaction [48]. Conversely, adaptive emotion regulation was associated with lower anxiety and depression [27].

1.2. Transdiagnostic cognitive behavioral therapy for improving FF mental health

The Unified Protocol for Transdiagnostic Treatment of Emotional Disorders (UP) [49–51] is an empirically supported, skills-based mental health treatment. Mechanistically, extensive research indicates that the UP improves negative emotionality by teaching effective emotion regulation skills [36,37,51–55]. It is efficacious for improving problematic anger, anxiety, depression, obsessive-compulsive symptoms, self-injury, somatization, substance misuse, and trauma-related symptoms [54,56–62]. Several pilot studies examining the UP for addressing PTSD reported positive findings [59–62]. Multiple RCTs indicate that improved negative emotionality and emotion regulation mediated reductions in mental health symptoms [52,53].

In the first trial of the UP in FFs [60], we enrolled treatment-seeking professional FFs. While no specific diagnosis was required for enrollment, many of these FFs reported clinically significant symptoms of PTSD, AUD, depression, and anxiety. A high proportion (80.3 %; 49 of 61) completed the full UP (12–16 individual sessions), underscoring its feasibility and acceptability among FFs. The UP was associated with large effect size improvements in symptoms of PTSD and depression and with medium-to-large improvements in symptoms of anxiety and AUD and quality of life, which were sustained at follow-up. We conducted a follow-up pilot of the UP with a mixed sample of emergency responders. We found similar results, including a high treatment completion rate and large improvements in PTSD symptom severity, depression, anxiety, functional impairment, and quality of life that were sustained at follow-up [63]. We also observed improvements in negative emotionality and emotion regulation, with greater improvements in these mechanisms linked with greater improvements in the outcomes.

1.3. Adapting the UP into a brief, peer-delivered, prevention intervention for FFs

The UP was designed to be flexibly adapted for use in multiple formats, which is facilitated by its modularized format and structured, skills-training approach [58]. The UP is a strong fit for mental health prevention, given that it broadly targets common, interrelated symptoms linked with negative emotionality [37,51]. The UP includes multiple emotion regulation skills, which is important since not all skills resonate with everyone. A single-session, group-based, 2-h version of the UP was tested in an RCT with young adults at risk for developing emotional disorders [64]. This brief workshop led to greater use of adaptive emotion regulation skills and greater improvements in negative emotionality, quality of life, and adaptive coping at follow-up compared to an assessment-only control group.

Peer delivery of such a prevention intervention confers advantages compared to delivery by mental health professionals, including greater credibility in the eyes of FF trainees and availability of trainers, given that the International Association of Fire Fighters (IAFF) has trained over 12,500 behavioral health peer support specialists. Our team has worked extensively with the IAFF peer support program and illustrated peer support specialists' preparedness to deliver such interventions. For example, we found that peer support specialists learned and competently delivered suicide safety planning [65]. In this project, 213 peer support specialists who completed the training reported a 7-fold increase from pre-training in completing a safety plan with an at-risk FF and that 98 % of those safety plans resulted in a positive outcome.

2. Material and methods

2.1. Institutional Review Board

This project was approved by the Institutional Review Board (IRB) at the Baylor Scott & White Research Institute.

2.2. Design

This two-arm cluster RCT ($N = 312$) will compare the efficacy of peer-delivered emotion regulation training based on the UP (ERT-UP) versus peer-delivered mental health psychoeducation (PSYED) delivered to recruits during the fire academy. Our goal is to determine which training is superior for preventing the development of PTSD and other mental health and functional outcomes during the first two years of fire service. Psychoeducation was chosen as the comparison because psychoeducation, delivered by a peer trainer or mental health professional,

represents the typical training that recruits receive regarding mental health during the academy. In this study, both interventions will be delivered by a peer trainer.

Our over-arching hypothesis is that ERT-UP, by teaching adaptive emotion regulation skills, will be superior in preventing posttraumatic stress and other mental health symptoms and in promoting psychosocial functioning. We hypothesize that the ERT-UP group will develop lower PTSD symptom severity (primary outcome) over time compared to PSYED (*H1*); ERT-UP will develop lower symptoms of AUD, depression, and anxiety, and less functional impairment (*H2a-H2d*); and that negative emotionality and emotion regulation will mediate the effect of ERT-UP on the outcomes (*H3a, H3b*). Given the lack of prospective data in trauma-exposed populations, we will *explore* whether ERT-UP leads to greater resilience and lower burnout, problematic anger, somatic symptoms, suicidal thoughts, and likelihood of leaving fire service. We will explore whether psychological flexibility may serve as an additional mediator of the effect of ERT-UP on the outcomes.

2.2.1. Randomization

Training classes at participating academies will be randomized to ERT-UP or PSYED. Individual recruits can choose whether to participate in the study. All recruits in each training class will receive the training to which their class is randomized, regardless of whether the individual recruit chooses to participate in the study. Because all recruits in each class will receive the same training, neither the other recruits nor academy leadership will know which recruits opted to participate. The same number of ERT-UP and PSYED trainings will be conducted at each academy. This will balance the number of trainings and participants across study conditions. This will also serve to balance the level of trauma exposure across conditions, as trauma exposure likely varies across departments. The order in which trainings will be delivered within each academy will be randomly determined by our statistician using SAS PROC PLAN.

2.3. Participants

2.3.1. Source of population

Participants will be recruited from approximately 10-12 academies in metro areas across the U.S. We will choose cities where FFs also serve as emergency medical personnel, as is the case in most metro areas. This makes it more likely that the study sample will report substantial trauma exposure during the study and reduces the likelihood of differences in mental health symptoms by department. To maximize the generalizability of findings, we will select cities with departments that have historically had greater diversity among their FFs, and we will seek geographical diversity.

2.3.2. Eligibility

In keeping with the nature of a study testing the impact of a relatively low-intensity training intervention designed for real-world implementation, we instated few exclusionary criteria. Eligible fire trainees must be 21 years of age, English-speaking, and willing to be contacted to complete the follow-up assessments. Potential participants will be excluded if they are pregnant due to constraints on active duty, have plans to relocate, report psychotic symptoms, report suicide risk at a level that warrants immediate referral for mental health treatment, or are currently dependent on substances other than tobacco or caffeine.

2.4. Recruitment and retention

Recruitment will occur at two levels – fire departments and individual FF recruits. We will recruit departments through our partnership with the IAFF, including advertising through IAFF communications and through personal connections between IAFF behavioral health leadership and leadership at academies. We will advertise through our regular presentations at conferences attended by fire service and academy leadership. Potential participants will be identified from training rosters provided by selected departments and contacted by phone and email before the ERT-UP or PSYED training date. Potential participants will be contacted up to 3 times per week for up to 1 month prior to the training date if they have not responded. A cover letter sent to potential participants will explain the protocol. Interested FF recruits may respond electronically or via the designated study phone. Interested recruits can also scan a QR code that leads to a Qualtrics form to provide their information to enroll. For interested departments, a staff member will give a short explanation of the study and protocol, in person or virtually, before the trainings occur in case any additional FF recruits want to enroll. The study procedures, schedule, and potential risks/benefits will be explained and presented in the consent form. Study staff will answer questions about the study. Interested recruits will be sent a link to the electronic consent form.

Participants will be provided a challenge coin for their time completing the baseline assessment and gift cards as incentives for their time completing the follow-up assessments. Participants will be compensated up to $200, including $30, $40, $50, and $80 for the 6-month, 12-month, 18-month, and 24-month follow-ups, respectively. Participants will be reminded via text message, email, and phone to complete the follow-up assessments.

2.5. Informed consent

Once a recruit indicates interest, project staff will offer to speak with them to explain the study and answer all questions before enrollment. Staff will provide an overview of the procedures and highlight the main elements of informed consent. Interested recruits will be sent a link to review and electronically sign the consent form, which details all procedures, the schedule, potential risks/benefits, protections from risk, and includes contact information for the IRB and the PI who may be contacted anytime with questions or concerns.

2.6. Measures

All measures are administered online via Qualtrics. The assessment schedule and details regarding the measures are provided in Table 1.

2.6.1. Eligibility screening measures

The Psychiatric Diagnostic Screening Questionnaire - Psychosis Module, Columbia Suicide Severity Rating Scale Screen Version (CSSRS-SV), and Drug Use Disorders Identification Test are used to screen for psychotic symptoms, suicide risk warranting crisis intervention, and dependence on substances other than tobacco or caffeine, respectively [66–68]. The presence of these exclusion criteria is anticipated to be rare in this population. Positive screens on any of these measures will be followed up by a phone call with a study clinician to determine if an exclusion criterion is met.

2.6.2. Primary outcome

PTSD Checklist for DSM-5 (PCL-5) to measure PTSD symptom severity [70].

2.6.3. Secondary outcomes

Alcohol Use Disorders Identification Test (AUDIT) [72], Generalized Anxiety Disorder-7 (GAD-7) [74], Patient Health Questionnaire-9 (PHQ-9) measure of depressive symptoms [75], and the Work and Social Adjustment Scale (WSAS) to measure functional impairment [76].

2.6.4. Exploratory outcomes

Connor-Davidson Resilience Scale 10 item version (CD-RISC-10) [77], Oldenburgh Burnout Inventory (OBI) [79], Columbia Suicide Severity Rating Scale Screen Version (CSSRS-SV) [67], Dimensions of Anger Reactions (DAR-5) [81], Patient Health Questionnaire–15 (PHQ-15) measure of physical health concerns [82], and Changes in

Table 1
Schedule and description of assessment measures.

Measures and description	Baseline	Post-Training	6, 12, 18, 24-month follow-up
A **Demographics Questionnaire** will be used to assess participant characteristics. 12 items.	x		
The **Psychiatric Diagnostic Screening Questionnaire (PDSQ)** [66] psychosis module will be used to screen for psychotic symptoms during the past 2 weeks. 6 items using a yes-no response format. An example item is "Did you think that you had special powers other people didn't have?" It exhibits adequate sensitivity and specificity for screening for psychosis [66].	x		
The **Drug Use Disorders Identification Test (DUDIT)** [68] will be used to screen for drug dependence. 11 items assess frequency of and consequences related to use. Item response formats vary. An example item is "How often do you use drugs other than alcohol?" It demonstrates adequate internal consistency, sensitivity, and specificity for drug dependence diagnoses [69]	x		
The **PTSD Checklist for DSM-5 (PCL-5)** [70] measures PTSD symptom severity in the past month and is the **primary outcome measure**. 20 items. Example item: "In the past month, how much have you been bothered by repeated, disturbing, and unwanted memories of the stressful experience?". 5-point scale from "*Not at all*" to "*Extremely*". It exhibited strong reliability and validity in samples of military veterans [70] and strong internal consistency (alpha = .96) in fire fighters [71].	x		x
The **Alcohol Use Disorders Identification Test (AUDIT)** [72] measures AUD symptoms and frequency and quantity of drinking over the past year. 10 items. Item response formats vary. Example item: "How often do you have a drink containing alcohol?". It exhibited high sensitivity and specificity for identifying hazardous drinking [73].	x		x
The **Generalized Anxiety Disorder-7 (GAD-7)** [74] Measures anxiety symptoms in the past 2 weeks. 7 items. Example item: "Over the last 2 weeks, how often have you been bothered by feeling nervous, anxious, or on edge?". 4-point scale from "*Not at all*" to "*Nearly every day*". It exhibited strong internal consistency and adequate sensitivity and specificity for generalized anxiety disorder in primary care patients [74] and strong internal consistency (alpha = .92 and .93) in a sample of emergency responders [63].	x		x
The **Patient Health Questionnaire-9 (PHQ-9)** [75] measures depression symptoms in the past 2 weeks. 9 items. Example item: "Over the past 2 weeks, how often have you been bothered by little interest or pleasure in doing things?". 4-point scale from "*Not at all*" to "*Nearly every day*". It exhibited strong internal consistency, sensitivity, and specificity in outpatient medical settings [75] and good internal consistency (alpha = .87 and .89) in emergency responders [63].	x		x
The **Work and Social Adjustment Scale (WSAS)** [76] measures impairment due to mental health in work, household tasks, social leisure activities, private recreation, and social relationships. 5 items. Example item: "Because of my mental health my ability to work is impaired." 9-point scale from "*Not at all*" to "*Markedly*". It exhibited good internal consistency (alpha = .86 and .89) in emergency responders [63] and adequate internal consistency and high correlations with mental health symptoms and an interview assessing functional impairment in patients being treated for depression [76].	x		x
The **Connor-Davidson Resilience Scale-10 item version (CD-RISC-10)** [77] measures resilience in relation to adversity over the past month. Example item: "I am able to adapt when changes occur." 5-point scale from "*Not true at all*" to "*True nearly all the time*". In college students, it exhibited good internal consistency and validity via a finding in which greater resilience scores moderated the relationship between childhood adversity and psychiatric symptoms [77] and strong internal consistency (alpha = .92) in ambulance personnel [78].	x		x
The **Oldenburg Burnout Inventory (OBI)** [79] measures occupational burnout. 16 items. Example item: "It happens more and more often that I talk about my work in a negative way." 4-point scale ranging from "*Strongly agree*" to "*Strongly disagree*". Internal consistency was adequate (alpha = .74 to .87) and there was strong evidence for construct validity in relation to other measures of burnout in samples of general employees and fire service personnel [79].	x		x
The **Columbia Suicide Severity Rating Scale – Screen Version (C-SSRS-Screen Version)** [67]. 6 items. Used to screen for suicide risk (eligibility criterion). Measures presence of suicidal thoughts and behaviors. Items use a yes-no response format. Example item: "Have you wished you were dead or wished you could go to sleep and not wake?". Validity was established in terms of identifying psychiatric inpatients who later died by suicide [80].	x		x
The **Dimensions of Anger Reactions-5 (DAR-5)** [81] measures anger frequency, intensity, duration, aggression, and impact on social functioning over the past month. 5 items. Example item: "I found myself getting angry at people or situations." 5-point scale from "*None or almost none of the time*" to "*All or almost all of the time*". Exhibited strong internal consistency (alpha = .90) and validity in terms of associations with other measures of anger and with PTSD [81].	x		x
The **Patient Health Questionnaire–15 (PHQ-15)** [82] measures health	x		x

(*continued on next page*)

Table 1 (*continued*)

Measures and description	Baseline	Post-Training	6, 12, 18, 24-month follow-up
concerns across multiple bodily systems over the past 7 days. 15 items. Example item: "During the past 7 days, how much have you been bothered by stomach pains". 3-point scale from "*Not bothered at all*" to "*Bothered a lot*". It exhibited adequate internal consistency (alpha = .80) and strong validity based on associations with clinician-rated symptoms, healthcare utilization, and functional outcomes [82].			
A **Change in Job/Duty Status Questionnaire** developed for this study will measure change(s) in employment status (i.e., no longer employed in fire service), promotion, or duty assignment changes. 6 items.			x
The **Big Five Inventory-2 Negative Emotionality Scale (BFI-2-N)** [83] measures the tendency to experience emotions typically characterized as negative such as sadness and anxiety. 12 items. Example item: "I am someone who worries a lot." 5-point scale from "*Disagree strongly*" to "*Agree strongly*". Exhibited strong internal consistency (alpha = .90) and validity in terms of high correlations with peer ratings and other measures of negative emotionality [83].	x		x
The **Difficulties in Emotion Regulation Scale-16 Item Version (DERS-16)** [84] measures facets of emotion dysregulation (emotional clarity, difficulties engaging in goal-directed behavior, impulse control difficulties, limited access to effective emotion regulation strategies, and non-acceptance of emotional responses). Example item: "I have difficulty making sense out of my feelings." 5-point scale from "*Almost never*" to "*Almost always*". We will use the total score. Exhibited strong internal consistency (alpha = .92) in psychiatric outpatients [84] and firefighters [85] and strong validity in terms of associations with the original DERS and related measures [84].	x		x
The **Acceptance and Action Questionnaire-II (AAQ-II)** [86] measures experiential avoidance and psychological inflexibility, defined as unwillingness or perceived inability to remain in contact with unwanted internal experiences resulting in efforts to avoid, escape, or alter these experiences even when doing so interferes with acting in ways that are aligned with one's personal values. 7 items. Example item: "My painful experiences and memories make it difficult for me to live a life that I would value." 7-point scale from "*Never true*" to "*Always true*". Exhibited adequate internal consistency (alpha = .84) across multiple samples and validity in terms of longitudinal associations with mental health and occupational outcomes [86].	x		x
The **Adverse Childhood Experiences (ACEs)** [87] measures exposure to childhood trauma. 10 items rated on a yes-no scale. Example item: "Prior to your 18th birthday, did a parent or other adult in the household often or very often swear at you, insult you, put you down, or humiliate you? Or act in a way that made you afraid that you might be physically hurt?". Validity is supported by associations between number of ACEs and a broad range of negative mental and physical health outcomes [87].	x		
The **Trauma History Questionnaire (THQ)** [88] measures exposure to events that likely qualify as traumatic according to Criterion A for PTSD. 24 items. Respondents indicate whether they have experienced each type of event (yes/no). If the event is endorsed, participants report the number of times they experienced this type of event, their approximate age when it occurred, and a brief description of the event. Example item: "Have you ever experienced a natural disaster such as a tornado, hurricane, flood or major earthquake, etc., where you felt you or your loved ones were in danger of death or injury?". Validity is supported by studies showing that greater number of events endorsed on the THQ are linked to greater PTSD symptoms [88].	x		x
The **Sources of Occupational Stress Scale-14 (SOOS-14)** [4] measures common occupational stressors during the past 10 shifts in fire fighters. 14 items. Example item: "Working with a substandard co-employee on emergency incidents or situations." 5-point scale from "*Not at all bothered*" to "*Extremely bothered*". Good internal consistency (.82–.86) and validity were established in terms of its relations with the longer, original SOOS scale, occupational outcomes, and mental health symptoms in two samples of fire fighters [4].			x
Two items drawn from a broader measure of stressors [89] will be used to measure **Discrimination and Harassment in the Workplace**. First item: "How often supervisor/coworkers make slurs or jokes about racial or ethnic groups; and about women". Second item: "In the last 12 months, how often have you: worked twice as hard to get the same treatment/evaluation; been watched more closely than other workers; been unfairly humiliated." 5-point scale from "*Never*" to "*1+times/week*". Endorsement of these items was linked with depressive symptoms and poorer physical health outcomes [89].	x		x
The **Interpersonal Support Evaluation List-12 (ISEL-12)** [90] measures perceived social support. 12 items. Example item: "I feel that there is no one I can share my most private worries and fears with." 4-point scale from "*Definitely false*" to "*Definitely true*". Strong internal consistency (alpha = .94) and validity in terms of negative associations with mental health symptoms were reported in a study of fire fighters [9].	x		x

(*continued on next page*)

Table 1 (*continued*)

Measures and description	Baseline	Post-Training	6, 12, 18, 24-month follow-up
A **Satisfaction Questionnaire** developed for this study will measure satisfaction with the workshops. 8 items. Example item: "I would recommend this training to other fire fighters." 5-point scale from "*Strongly disagree*" to "*Strongly agree*".		x	
A **Knowledge Questionnaire** developed for this study will evaluate knowledge acquired from the workshops. 12 items. Example item from the ERT-UP knowledge questionnaire: "How are emotions adaptive?". Multiple choice response format. Administered pre- and post-workshops.		x	
A **Skill Use Questionnaire** developed for this study will measure frequency of use of skills learned during ERT-UP training in the past month. 9 items. Example item: "Caught yourself engaging in a thinking trap such as jumping to conclusions, catastrophizing, or black-and-white thinking in relation to a challenging emotional experience." 5-point scale from "*Never*" to "*Most Days*".			x

Job/Duty Status using a measure developed for this study.

2.6.5. Hypothesized mechanisms

Big Five Inventory-2 Negative Emotionality Scale (BFI-2-N) [83], and Difficulties in Emotion Regulation Scale-16 item version (DERS-16) [84].

2.6.6. Exploratory Mechanism

Acceptance and Action Questionnaire-II (AAQ-II) [86].

2.6.7. Trauma exposure, occupational stress, and social support (sample characteristics)

Adverse Childhood Experiences (ACES) [87], Trauma History Questionnaire (THQ) [88], Sources of Occupational Stress Scale-14 (SOOS-14) [4], Items measuring Discrimination and Harassment in the Workplace drawn from a broader measure of stressors [89], and the Interpersonal Support Evaluation List (ISEL-12) measure of perceived social support [90].

2.6.8. Measures to evaluate the training conditions

We will use a Satisfaction Questionnaire and a Knowledge Questionnaire to evaluate satisfaction with and knowledge gained from the workshops. We will use a Skill Use Questionnaire to measures frequency of use of skills learned during ERT-UP training. These measures were developed for this study.

2.7. Training interventions

ERT-UP and PSYED will each last 4 h. During the introduction to both trainings, there will be a brief discussion of the importance of mental health in fire service and a brief video aimed at combating mental health stigma in fire service. This content will be identical across conditions and is designed to optimize engagement by highlighting the importance of the topic. Four senior IAFF peer support trainers will serve as the interventionists. Each interventionist will only deliver one training to minimize contamination across conditions. Two interventionists were randomly assigned to deliver each training. Each pair of interventionists will complete a two-day training session with the study team. Interventionists will be provided with the intervention protocol in advance, using a format similar to that of the IAFF Instructor training course. During each training, the PIs will review and discuss the training with the entire team. The interventionists will practice delivering the intervention with study team members serving as mock participants. Practice sessions will be evaluated for fidelity to the respective intervention. The PIs will provide feedback to the interventionists. A research assistant will be present during each of the actual trainings at the academies and will complete fidelity ratings during these trainings.

2.7.1. ERT-UP

We developed ERT-UP in collaboration with FF peer support specialists to ensure fit with fire service culture. ERT-UP consists of the following modules: 1) understanding emotions and identifying antecedents-responses-consequences; 2) mindful emotion awareness; 3) cognitive flexibility; and 4) countering emotion-driven behaviors. Each module includes didactic teaching, experiential exercises, and one video per module featuring peer support specialists role playing a scenario in which they apply the emotion regulation skill. See Table 2 for details regarding each module. Following the workshop, the video from each module will be sent to participants electronically. One video will be sent weekly, beginning one week after the workshop.

2.7.2. PSYED

PSYED consists of the following modules: 1) PTSD; 2) mood and anxiety disorders; 3) alcohol and drug problems; and 4) suicide. All content was reviewed with fire service collaborators to ensure cultural attunement. Each module includes didactic teaching and experiential exercises (see Table 2). Following the workshop, four videos in which a peer support specialist summarizes material presented in each module will be sent to participants electronically. One video will be sent per week, beginning one week following the workshop.

2.8. Data analytic plan

We will use structured data analyses to examine group and individual patterns of development of PTSD symptom severity (primary outcome) and other psychological health symptoms and functional impairment after FF recruits receive ERT-UP or PSYED. The assessment design allows us to examine patterns of symptom fluctuation over time, as well as variables that mediate these patterns. The study design is based on a measurement model that collects predetermined, repeated assessments over two years, beginning with a baseline assessment before the training intervention, followed by evaluations every 6 months (5 assessments in total). The distribution of women and minorities in the sample may preclude comparisons by gender or minority status. Before conducting the primary analyses, we will scan and check the data via descriptive statistics (e.g., mean, standard deviation, skewness, and kurtosis), outlier analyses, evaluation of recruitment and retention, missing data analyses, and correlation analyses. Moreover, we will conduct psychometric analyses (e.g., internal consistency and factor analyses) to ensure all measures have adequate reliability and validity. Descriptive and psychometric analyses will be performed at each time point. Given the multilevel structure of the data (repeated measures nested within firefighters and firefighters further nested within intervention groups), we will adopt the multilevel structural equation models to analyze the data. All proposed models will be evaluated with the overall model chi-square test and other commonly used fit indices (i.e., RMSEA, SRMR, TLI, and CFI) [91]. will be analyzed using Mplus (V8.11). Potential data dependency due to the multilevel structure (e.g., FFs from the same fire department) will be considered via the robust estimation method MLR via the Type = Complex and Type = Twolevel routine in Mplus. To control for the potential confounding effect of trauma exposure, we will include it as a covariate in all the analyses.

Table 2
Overview of emotion regulation training-unified protocol (ERT-UP) and psychoeducation (PSYED) training conditions.

ERT-UP		
Module	Content	Exercises
1. Under-standing emotions	• Why understanding emotions is important for fire fighters • Addressing mental health stigma in fire service • How emotions are adaptive • ARC framework: Antecedents, parts of an emotional Response (physical, cognitive, behavioral), Consequences of an emotional response	• Work through recent disagreement using ARC • View and discuss video demonstrating use of ARC to analyze a stressful experience
2. Mindful emotion awareness	• What mindfulness is – and is not • Benefits of mindful emotion awareness • Different ways of practicing mindful emotion awareness, including anchoring in the present using the STAR technique (Stop, Three-point check, Ask, Respond)	• Mindfulness practice incorporating awareness of breath, bodily sensations, and thoughts • Mood induction using music • View and discuss video demonstrating use of STAR
3. Cognitive flexibility	• Cognitive flexibility defined • Common barriers to flexible thinking • Goals of cognitive flexibility • Questions to aid in cognitive flexibility using CATCH: (jumping to conclusions?; another way of looking at it?; what would I tell a friend/crew member?; is there contrary evidence?; even if true, is my thought helpful?)	• Review how cognitive flexibility may be applied to a common scenario in fire service • View and discuss video demonstrating use of cognitive flexility related to a stressful experience
4. Countering emotion driven behaviors	• Define emotionally driven behaviors • Types of emotionally driven behaviors • Evaluating short- and long-term consequences of emotionally driven behaviors highlighting alcohol use • Identifying and choosing alternative behaviors • Developing an individualized emotion management plan	• Review how to identify, evaluate, and counter common stress related, emotion driven behaviors • View and discuss video demonstrating countering emotion driven behaviors
PSYED		
Module title	Content	Exercises
1. Posttraum-atic stress disorder (PTSD)	• Definition and prevalence of mental health disorders • Addressing mental health stigma in fire service • Signs and symptoms of PTSD	• Discuss concept of mental health disorder • Discuss difference between stress and trauma • Introduce case study of fire fighter used throughout PSYED
2. Mood and anxiety disorders	• Prevalence, signs, and symptoms of: depression, mania and bipolar disorder, different anxiety disorders, obsessive compulsive disorder	• Discussion of difference between “normal ups and downs” and mood and anxiety disorders • View and discuss video demonstrating antecedents, experience, and consequences of a panic attack
3. Alcohol and drug problems	• Defining an alcohol or substance use disorder • Prevalence, signs, and symptoms of alcohol and other substance use disorders • Standard drinks and hazardous use	• Revisit case study of fire fighter: Relationship between anxiety and alcohol use
4. Suicide	• Prevalence • Suicide and fire service • Affect of suicide on those who knew the person who died • Risk factors and warning signs • Steps to take in cases of risk to self or others	• Discussion of relationship between fire service, fire service culture, and suicide risk factors

2.8.1. Power analysis and sample size determination

Our sample size was determined by detecting a between-group difference in the primary outcome over time. Based on prior literature [57,60,61,63], we anticipate a medium-sized between-groups effect (d = .50) of ERT-UP compared to PSYED. Based on our experience with both longitudinal observation and intervention research with FFs, we anticipate ~15 % attrition during the study. We used the Optimal Design Plus (V3.01) software package to conduct the power analysis. Assuming a .10 intra-class correlation (ICC) which is common in behavioral and social science research, the anticipated attrition rate, and 5 repeated measures (1 baseline plus the 6-month measurements for 2 years; 5 total measurements), the required sample size for detecting a medium-sized difference between groups on the primary outcome with adequate statistical power (.80) is 24 total intervention groups (12 ERT-UP; 12 PSYED) with 13 firefighters per group, for a total of 312 FFs.

2.8.2. Addressing hypotheses

H1: ERT-UP will develop lower PTSD symptom severity over time compared to PSYED. To test this hypothesis, we will utilize a piecewise latent growth model (LGM). Group will be dummy coded and used as the time-invariant covariate to predict the intercept factor, piece1 linear growth factor, and piece2 linear growth factor. The piecewise model can capture the potential different rate of change during the study period: piece1 includes time from baseline (month 0) to the first post-treatment measure (at month 6), whereas piece2 includes follow-up measures from month 6 to month 24. The longitudinal group mean difference can be examined by the statistical significance of the path from ERT-UP/PSYED to Slope_P2.

H2a-H2d: ERT-UP will develop lower symptoms of AUD, depression, and anxiety, and lower levels of functional impairment over time. We will use the same model setup used to test *H1* to test the immediate and longitudinal group mean differences on these secondary outcomes. We expect to observe statistically significant differences in paths from ERT-UP/PSYED to these outcomes and the corresponding piecewise growth factors.

H3a, H3b: The theorized mechanisms, negative emotionality and emotion regulation, will mediate the effect of ERT-UP on the outcomes. We will test the longitudinal mediation effect through the bivariate piecewise LGM. The hypothesized mediation effects will be tested via the Model Indirect function in Mplus in which both Sobel test and the bootstrapping method are available [92].

Exploratory analyses: We will explore whether ERT-UP leads to greater resilience and lower burnout, problematic anger, somatic symptoms, suicidal thoughts, and likelihood of leaving fire service compared to PSYED using the same analytic approach as for *H1*. We will explore whether psychological flexibility may mediate the effect of ERT-UP using the same analytic approach as for *H3*.

3. Conclusion

There is increasing awareness of the need for training and preparation to prevent the development of mental health challenges and related outcomes among emergency responders and other high-risk professions. Our long-range goal is to identify an acceptable, efficacious, and scalable

approach to prevent or mitigate workplace psychological injuries. This is the first RCT of a mental health prevention intervention with fire service recruits, an important but understudied group. We are comparing two training interventions. Both are delivered by peers, a culturally attuned and scalable approach. ERT-UP teaches evidence-based, adaptive emotion regulation skills linked with lower symptom levels. PSYED resembles the mental health education typically delivered during fire academies. This trial involves randomization of a fully powered sample of FFs and a battery of well-validated measures to examine the outcomes, along with mechanistic measures. Other variables represent exploratory outcomes and potential moderators of treatment response. If ERT-UP is more efficacious than PSYED in preventing the development of PTSD symptoms and other negative outcomes, this would have immediate implications for dissemination and implementation in fire service. More broadly, such an approach could be adapted for other occupational groups. Conversely, if the trainings have equivalent effects, our assessment battery includes measures of satisfaction, knowledge, and behavior change that would inform future refinements to mental health training in fire academies.

CRediT authorship contribution statement

Eric C. Meyer: Writing – original draft, Methodology, Conceptualization, funding acquisition, Multiple principal investigators. **Todd Farchione:** Writing – review & editing, Methodology. **Nathan A. Kimbrel:** Writing – review & editing, Methodology. **Oi-Man Kwok:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Michelle L. Pennington:** Writing – review & editing, Project administration, Investigation, Conceptualization. **Jessica Rostockyj:** Writing – review & editing, Methodology, Funding acquisition. **Suzy B. Gulliver:** Writing – review & editing, Methodology, Investigation, Funding acquisition, Conceptualization, Multiple principal investigators.

Role of the funding source

The funding source has or has had no involvement in the study design, the collection, analysis and interpretation of data, the writing of this report, or the decision to submit this article for publication.

Disclaimer

The views expressed herein are solely those of the authors and do not reflect an endorsement by or the official policy or position of Baylor Scott & White Health or any of our academic institutions.

Contribution to the field statement

The present manuscript describes a fully powered, randomized controlled trial comparing two different training interventions – delivered during the fire academy – for preventing the development of posttraumatic stress and other mental health challenges in 312 fire fighter trainees. The first intervention provides training in four evidence based emotion regulation skills. The second intervention takes a psychoeducational approach, which is the standard type of mental health training that fire fighter trainees receive. Both trainings will be delivered by peers, and our research team includes fire fighters. Fire fighters, along with other emergency responders and people working in other high risk occupational groups, are at elevated risk for posttraumatic stress and other mental health challenges as a function of elevated exposre to psychological trauma, as well as to other occupational stressors. Thus, emergency responders should be equipped with evidence based skills for managing the emotional distress that lies at the core of a range of mental health disorders. High levels of emotional distress are also linked with a myriad of physical health problems. Thus, the findings of this study will provide important information comparing two different approaches to preparing fire fighter trainees for the emotional toll involved in entering this high risk profession. The decision to use emotion regulation training is based on extensive research that highlights the prominent role of negative emotionality and emotion regulation skills in influencing responses to traumatic stress and overall mental health. The emotion regulation training is based on an influential, contemporary psychological treatment called the Unified Protocol for Transdiagnostic Treatment of Emotional Disorders that has extensive evidence supporting its positive influence on levels of negative emotionality, emotion regulation skills, and mental health symptoms. Should the findings of this study warrant broader dissemination and implementation of the emotion regulation training, the peer-delivered format makes it scalable to implement within fire service. Thus, this study has the potential to contribute to positively impacting health and wellbeing in fire service.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

No data was used for the research described in the article.

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Abbreviation

FF: Firefighters
RCT: Randomized controlled trial
PTSD: Post-traumatic stress disorder
AUD: Alcohol use disorder
SPIRIT: Standard Protocol Items:Recommendations for Interventional Trials statement
CBT: Cognitive behavioral therapy
UP: Unified Protocol for Transdiagnostic Treatment of Emotional Disorders
ERT-UP: Emotion-regulation training based on the Unified Protocol
PSYED: Psychoeducation
IAFF: International Association of Firefighters