



REVIEW ARTICLE

Coping among public safety personnel: A systematic review and meta-analysis

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Abstract

Public safety personnel (PSP) are routinely exposed to potentially psychologically traumatic events (PPTs) that, in turn, can result in posttraumatic stress injuries (PTSI), including burnout and increased symptoms of depression and anxiety. However, the longitudinal impact of PPTs on PSP coping remains unclear. Coping can be operationalized as various strategies (i.e., behaviours, skills, thought and emotion regulation) for dealing with stressors, which are broadly categorized as either approach (adaptive, positive, social support) or avoidant coping strategies (maladaptive withdrawal, avoidance, substance use). This systematic review and meta-analysis aims to evaluate longitudinal coping outcomes among PSP. Thirteen eligible repeated-measures studies explicitly evaluated coping in 1854 police officers, firefighters, and rescue and recovery workers. Study designs included randomized-control trials, within-subject interventions and observational studies. Effect sizes (Cohen's *d*) at follow-up were described in 11 studies. Separate meta-analyses reveal small ($d < 0.2$) but non-significant improvements in approach and avoidant coping. Studies were of moderate quality and low risk of publication bias. Heterogeneity in outcome measures, follow-up durations, and study types precluded subgroup analyses. The current findings can inform the development and evaluation of organizational training programs that effectively promote sustained adaptive coping for PSP and mitigate PTSIs.

KEYWORDS

coping, meta-analysis, occupational health, organizational stress interventions/prevention, posttraumatic stress, public safety personnel, traumatic stress

1 | INTRODUCTION

Public safety personnel (PSP) are at the forefront of keeping communities safe. The definition of PSP includes, but is not limited

to, police, firefighters, paramedics, border services officers, communications officials (e.g. dispatch or 911 operators), and correctional workers (Canadian Institute for Public Safety Research and Treatment [CIPSRT], 2020). PSP are more frequently exposed to

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potentially psychologically traumatic events (PPTs) than the general population due to their occupations (Carleton, Afifi, Taillieu, Turner et al., 2019a; Carleton, Afifi, Turner, Taillieu 2018, 2020). Over time, the repeated exposure to PPTs put PSP at increased risk for adverse psychological outcomes, including posttraumatic stress injuries (PTSI) (Carleton, Afifi, Turner, Taillieu, Durand et al., 2018a; Ricciardelli et al., 2020). The term PTSI is a broad construct that refers to the development of psychopathology following exposure to a traumatic event, which may include a discrete diagnosis of posttraumatic stress disorder (PTSD), although PTSIs can involve subthreshold symptoms of many mental disorders and encompass a range of psychological issues, such as depression, anxiety, suicidal ideation, stress, burnout and substance use (Angel, 2016; Carleton et al., 2020; Keynan & Keynan, 2016). There is mounting evidence that PSP are more likely to experience several mental disorder sequelae, including increased risk for suicidality (i.e., suicidal ideation, planning and attempts) and substance abuse (cf. Berger et al., 2012; Carleton, Afifi, Turner, Taillieu, LeBouthillier et al., 2018; Di Nota et al., 2020; Stanley et al., 2016). Given the increased burden of the COVID-19 pandemic, identifying protective factors to cope with and mitigate PSP-specific mental health challenges is more urgent than ever.

Due to the trauma-informed work environment and high stress that PSP encounter regularly, personal coping strategies are central elements of PSP self-care (Lanza et al., 2018). Coping is a broad psychological concept defined as 'efforts to prevent or diminish the threat, harm and loss, or to reduce associated distress' related to a psychological stressor (Carver & Connor-Smith, 2010, p. 685). Historically, Lazarus and Folkman (1984) were among the first to use the term 'coping' to describe the cognitive and behavioural patterns used to manage stress—generally categorized as emotion-focused or problem-focused coping (Garcia, 2010; Lazarus & Folkman, 1984). While the concept of coping has been long established, to date, there is no universally accepted or formal clinical definition of coping.

Coping is often operationalized as various strategies (i.e., behaviours, skills, or ways of regulating thoughts and emotions) for dealing with stressors. For PSP, psychological stressors could include occupational PPTs and their associated emotional and cognitive effects. Strategies used to help PSP cope allow them to direct effort to recognize and process physical or psychological stressors that cause distress, and then determine the best approach to address stressors that exceed one's immediate resources (Anshel, 2000; Krohne, 2002; Lazarus & Folkman, 1984). These coping strategies are commonly dichotomized with Fauerbach et al. (2009) defining coping strategies as self-regulatory techniques that either confront the situation or stressor (approach strategies) or avoid the situation or stressor (avoidance strategies). Many synonymous terms exist in the literature to describe this dichotomy, such as positive, adaptive, engagement, and approach coping versus negative, maladaptive, disengagement, and avoidant coping (Anshel, 2000; Skinner et al., 2003).

Seminal coping research defines approach coping as any strategy that directly confronts a stressor and its related emotions (Moos & Schaefer, 1993; Skinner et al., 2003). Examples of approach coping

include seeking social support or adaptive emotion regulation techniques such as acceptance and positive reframing (Carver & Connor-Smith, 2010). By confronting stressors, approach coping strategies enable individuals to (a) minimize the negative psychological impact of stressors and (b) promote positive psychological outcomes when faced with future stressors. However, avoidant coping refers to any strategy that aims to escape or evade a stressor and its related emotions (Moos & Schaefer, 1993; Skinner et al., 2003). Examples include withdrawal or disengagement, denial, wishful thinking, emotion or thought suppression, and substance use (Carver & Connor-Smith, 2010). Avoidant coping strategies serve to distract and assuage negative emotions in the immediate or short-term but are often considered ineffective due to their long-term adverse health implications (Suls & Fletcher, 1985; Wills & Hirsky, 1996). Despite the negative connotation of the terms 'suppressive' or 'avoidant', researchers have shown that there are some possible positive benefits to such an approach (Bonanno et al., 2004). A simple binary approach to categorizing coping strategies may well oversimplify an exceptionally complex process. It is reasonable to assume that approach-focused coping does not always enhance positive affect and avoidant-focused coping does not always enhance negative affect.

In some cases, avoidance-focused coping may provide time for recovery post-event in a protective manner. Hence, the successful adaptation may depend less on the specific process but rather the ability to flexibly enhance or suppress emotional expression according to situational demands (Bonanno et al., 2004; Mayne & Bonanno, 2001). Further, the effectiveness of specific emotion regulation strategies depends on the interaction of the features of a situation and the individual's personality characteristics regulating their emotions (Barrett & Gross, 2001; Kobylińska & Kusev, 2019). Effective coping appears to depend on the congruence between the perceived stressor and an individual's chosen coping strategy, as mediated by one's personal appraisal of the threat stressful event (Anderson et al., 2002; Anshel, 2000).

What remains unclear is identifying specific coping strategies that effectively mitigate the impact of PTSIs among PSP.

Higher rates of PTSI symptoms among PSP have been shown to negatively impact the quality of occupational performance and interpersonal relationships, increase absenteeism, burnout and sleep difficulties, and contribute to early mortality (Anderson et al., 2002; Gerber et al., 2010; Lopez, 2011). The associated high costs of PTSI have prompted several stakeholder organizations and occupational health policymakers to seek proactive approaches, such as implementing mental health training programs to mitigate the impact of PPT on workers (Iacobucci, 2014; Weiss, 2019). Interventions aimed at protecting PSP mental health have typically focused on building resilience and managing occupational stress while coping is inconsistently measured, if at all. For example, several researchers have shown improved physiological stress responses following conditioning of the autonomic nervous system among police (Andersen et al., 2018; Arble et al., 2017; Arnetz et al., 2009). Various other types of organizational interventions show modest reductions in PTSI

symptoms (i.e., small effect sizes) that are time-limited (Beshai & Carleton, 2016; Carleton, Korol et al., 2018c, Carleton et al., 2019b; McCreary, 2019), including online resilience training modules that have low adherence rates (Joyce et al., 2018, 2019). These findings are also apparent in trainee paramedics (Anderson et al., 2017; Vaughan et al., 2020) and nurses (Anderson, Black, Collins & Vaughan, 2019). Also, coping skills obtained through resilience training can be expected to deteriorate like other learned skills (Andersen et al., 2018; Anderson et al., 2017, 2019), meaning refresher programs are likely critical for maintaining gains. Whether due to ineffectiveness of the interventions themselves or a lack of consistent organizational support, the interventions mentioned above fail to identify effective strategies that support long-term coping following PPTEs, which is particularly relevant for PSP. Given mounting evidence that stigma substantially inhibits care-seeking for mental health challenges in these populations (Carleton et al., 2019a, 2019b; Ricciardelli, 2018; Ricciardelli et al., 2018), occupational training that emphasizes adaptive coping to work-related exposures may be better suited for initial or basic training. While having social supports and tolerating uncertainty are critical to resilience and handling of stress, recent evidence suggests that these factors are also relevant to protecting PSP from adverse psychological outcomes following PPTE (Angehrn et al., 2020; Vig et al., 2020). However, there remains a gap in the literature surrounding which coping methods effectively mitigate PTSIs and promote mental health over time among PSP.

2 | OBJECTIVES

The current study was designed as a systematic literature review to identify published research on longitudinal coping outcomes among PSP and evaluate changes in coping over time with a meta-analysis. Results are presented to summarize the various methodological approaches (i.e., interventions, observational studies), durations, and outcomes evaluated in recent empirical repeated-measures studies of coping. The current results can help industrial, organizational, and occupational stakeholders develop, evaluate, and implement evidence-based programming that effectively mitigates PTSD among PSP and others exposed to PPTE.

3 | METHODS

3.1 | Eligibility criteria

The current systematic literature review procedures followed PRISMA guidelines (Liberati et al., 2009; Figure 1), and the search strategy followed a population-intervention-comparison-outcome (PICO) framework (Table 1). Given the vast heterogeneity in coping terminology in the extant literature, for the purpose of this review, the terms 'approach' and 'avoidant' coping were used. Restricted review eligibility were limited to peer-reviewed English- or French-

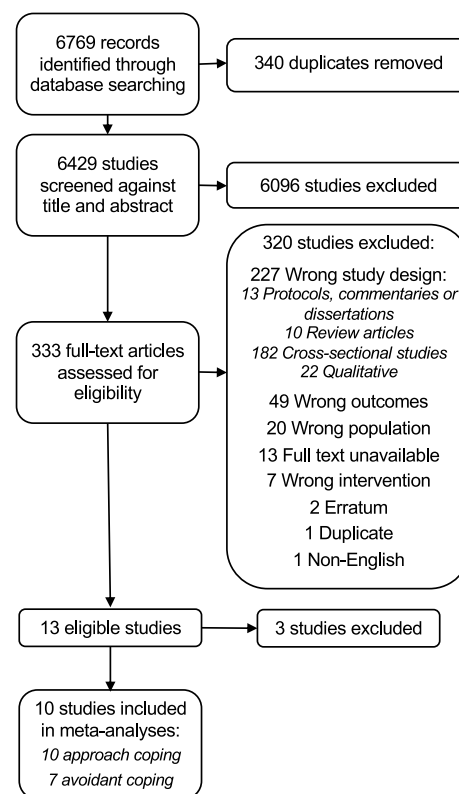


FIGURE 1 PRISMA flow diagram

language studies involving adult PSP (aged 18 and older) published between 1 January 2000, and 9 December 2019 that explored coping—whether in response to a discrete PPTE, or general exposure to PPTE due to their occupation as PSP. PSP were defined per the CIPSRT glossary (2020) and keywords included: border services, communications officials, corrections or correctional officers, firefighter, paramedic, police, search and rescue, and emergency services. Eligible outcomes included empirically derived, validated psychological measures of coping, such as the Brief COPE (Carver, 1997) and Ways of Coping Questionnaire (Folkman & Lazarus, 1988), as well as theoretically derived coping measures. Eligible study designs included randomized control trials (RCT) and quasi-experimental studies (e.g., within-subject pre-post intervention or observational studies).

Exclusion criteria included studies evaluating non-PPTE-related occupational stressors (e.g., work-related demands, organizational stress), non-peer-reviewed theses or dissertations, non-experimental designs (e.g., protocols), qualitative studies, and cross-sectional (i.e., single timepoint) studies.

3.2 | Search procedures

Boolean searches combining keywords of interest were conducted in the following electronic databases: EMBASE, MEDLINE, PsycINFO, PubMed and Web of Science. Searches were supplemented with hand-searches of reference lists from relevant studies and earlier

TABLE 1 PICO search strategy and search terms

Domain	Target	Search Terms
Population	PSP	Border services Communications officials Corrections or correctional Firefighter Paramedic Police Search and rescue Emergency services Officers
Intervention	Coping	Coping Coping strategies Approach Avoidance or avoidant Problem-focused Emotion-focused Trial Pre-post
Comparison	Control group (for intervention studies)	Randomized control trial
Outcome	Coping measures	Coping Strategies Inventory Coping strategy indicator Coping orientation to problems experienced Brief COPE Ways of Coping Questionnaire

published review articles and reports. Following the searches, all citations were imported into Covidence—a web-based systematic review manager (Veritas Health Innovation, 2019). Two independent reviewers (Paula M. Di Nota, Emily Kasurak) screened all results against the eligibility criteria, first by title and abstract, and then the full-text article. All discrepancies were examined by a third reviewer (Gregory S. Anderson) for final decisions. Within Covidence, interrater reliability was measured using Cohen's kappa across the title/abstract and full-text review stages, which were 0.69 and 0.75, respectively. Accordingly, this suggests a substantial agreement between reviewers on article selection (McHugh, 2012). To that end, all discrepancies were resolved with consensus between the two reviewers.

3.3 | Data extraction

Two reviewers (Paula M. Di Nota, Emily Kasurak) extracted data independently from published full-text reports of eligible articles. Population variables of interest included PSP occupation, sample size, and if provided, demographic information related to participant age,

sex, role/position/rank, and years of employment. Intervention variables included repeated-measures study design, and if an intervention study, a description of the program's delivery and duration as reported by study authors. Comparison variables included the type and nature of the comparator group (e.g., waitlist control or within-subject design). Outcome variables of interest included validated psychological measures of coping (e.g., Brief COPE (Carver, 1997)) as well as outcomes related to theoretically supported forms of approach coping, including social support (e.g., Social Support Scale [Caplan et al., 1975]), and avoidant coping, including substance use, thought suppression (White Bear Suppression Inventory [Wegner & Zanakos, 1994]) and experiential avoidance (e.g., Acceptance & Action Questionnaire [Hayes et al., 2004]).

3.4 | Quality assessment

Study quality was appraised using the Newcastle-Ottawa Scale (Wells et al., 2019), which evaluates nine items across three domains: selection, comparability, and outcome. Each item received a rating of high, low, or unclear risk of bias. Each instance of a low risk of bias

counted as one point, for a total possible score of nine. Overall study quality was operationalized using the total score: scores of 9 as 'high quality', scores of 7 or 8 as 'moderate to high quality', scores of 5 or 6 as 'moderate to low quality', and scores below five as 'low quality'.

3.5 | Synthesis of results

Statistical analyses were conducted in R studio version 3.5.3 (RStudio Team, 2020) using the *meta* package, which runs random-effects meta-analysis models to pool effect sizes across studies. For inclusion in the quantitative meta-analysis, studies were required to report means, standard deviations, and sample sizes at the pooled study endpoint for each outcome of interest (see Appendix A). Studies that reported standard errors were converted to standard deviations by multiplying the standard error by the square root of the sample size. Across studies, there were only continuous outcomes (e.g., scores on instruments). Therefore, all effect sizes were pooled using Cohen's standardized mean differences (SMD, *d*) and their corresponding 95% confidence intervals (95% CI). According to Cohen's criteria (Cohen, 2013; Faraone, 2008), SMD values of 0.2 were interpreted as 'small', 0.5 as 'medium', and 0.8 or greater as 'large'.

Given the heterogeneity in outcome measures across studies (Appendix A), composite outcome measures were created for 'approach coping' and 'avoidant coping', based on the directionality of the scores for a specific coping instrument. For example, an increase in any of the approach subscales of the Brief COPE (e.g., planning, humour and acceptance) indicated improved coping, whereas a decrease in any of the avoidant subscales of the Brief COPE (e.g., substance use, behavioural disengagement) also indicated better coping. The diversity in assessment instruments used across studies provided further justification for using the SMD to standardize effect sizes. As there were an insufficient number of studies (i.e., more than three) reporting the same outcome at the same follow-up period, all follow-up durations were pooled within and across studies (e.g., Brief COPE at 6-month and 9-month follow-up were pooled to a single follow-up timepoint). For within-subject cohort studies, effect sizes were calculated by measuring the difference between the baseline and follow-up scores on the instruments; for RCTs, effect sizes were calculated by measuring the difference between the experimental and follow-up scores and control groups. For crossover RCT studies, only data from the first half of the study (i.e., before the crossover) were considered.

3.6 | Assessment of heterogeneity and additional analyses

Heterogeneity was quantified using the I^2 statistic (Higgins & Thompson, 2002) and forest plots, which are graphs depicting summary effect sizes across studies (Kang et al., 2016). Where possible, we explored for additional sources of heterogeneity using pre-specified subgroup analyses by PSP occupation (e.g.,

firefighters, police officers), intervention category (e.g., psychological interventions vs. physical activity such as leisure activity or physical exercise), and study design (e.g., randomized controlled trial vs. within-subject intervention and/or observational study). The robustness of our findings was assessed by conducting sensitivity analyses, such as comparing the effect sizes from the random-effects and fixed-effects model. To measure publication bias, funnel plot asymmetry was measured using Egger's test (Begg & Mazumdar, 1994). Meta-regression analyses were also performed to determine the impact of the study's age and sex distribution on effect size. Given the expectation that coping skills deteriorate over time (Vaughan et al., 2020), three post-hoc meta-regression analyses were performed by time-since event, the duration of treatment, and the time to follow-up.

4 | RESULTS

A total of 6769 studies were identified by the systematic review, and 6429 unique studies after removing 340 duplicates. After title and abstract screening, 6096 records were removed, leaving 333 studies for full-text review. An additional 320 studies were excluded at the full-text stage for the following reasons: wrong study design (i.e., protocols, theses, reviews, commentaries, qualitative or cross-sectional studies, $n = 227$), wrong outcomes (i.e., studies that did not report coping as an outcome measure, $n = 49$), wrong population ($n = 20$), full-text articles unavailable ($n = 13$), wrong intervention (i.e., work satisfaction, $n = 7$), erratum ($n = 2$), duplicate ($n = 1$), non-English full-text ($n = 1$). The current systematic review found 13 eligible studies. Key study characteristics including quality assessment rating, participant summaries, study designs, intervention descriptions and durations (if applicable), evaluation periods, primary outcomes and results were tabulated and are described below and summarized in Table 2.

4.1 | Study characteristics

The 13 studies represented data from 1854 individuals. Police officers were the most common PSP occupational group ($n = 9$), followed by firefighters ($n = 3$) and rescue and recovery workers ($n = 1$). Between-subject RCTs (including cluster, parallel, and crossover) and within-subject observational studies were the most common study design types ($n = 6$ each). For the intervention studies ($n = 7$), program durations ranged from a single 90-min group session (Tuckey & Scott, 2014) to several-day workshops (Ranta, 2009) or longer weekly training sessions up to 32 weeks (Acquadro Maran et al., 2018). Follow-up evaluations ranged from immediately following the intervention or PPTE ($n = 4$), 1 to 3 months ($n = 5$), 6 to 12 months ($n = 5$), 24 to 28 months ($n = 2$), and one study at 10-year follow-up (de Terte et al., 2014). A single study with multiple follow-up durations would be included in more than one of the categories (e.g., Alghamdi et al., 2015 conducted pre-, post-intervention, 3- and 6-month evaluations).

TABLE 2 Summary characteristics of eligible studies yielded in systematic literature review ($n = 13$)

Study (quality)	Population (n) country	Intervention description	Intervention duration	Evaluations	Outcomes	Results
Randomized control trials						
Acquadro Maran et al., 2018 (moderate-low)	Police (105) Italy	Physical exercise versus wellbeing classes	1.5 h/week \times 32 weeks	10 weeks pre-training, 3 months follow-up	Brief COPE (active coping, emotional support, instrumental support, positive reframing, planning, humour, acceptance, religion, self-distraction, denial, substance use, behavioural disengagement, venting, self-blame subscales)	Increased adaptive coping and decreased maladaptive coping post-intervention overall. Less self-distraction and more active coping following physical intervention, opposite for wellness group
Alghamdi et al., 2015 (moderate-high)	Firefighters (34) Saudi Arabia	NET versus WLC	90 min \times 4 sessions (over 3 weeks)	Pre-training, post-training, 3 months, 6 months follow-up	Brief COPE active (planning, religion, positive reframing) and passive (behavioural disengagement, substance abuse, self-blame) subscales; SSS (family, friends, and NGO subscales)	Reduction in passive coping strategies immediately post-treatment, and sustained increase in social support. Changes in primary outcomes (PTSD, depression, anxiety) not sustained at follow-up
Fischetti et al., 2019 (moderate-low)	Police (20) Italy	Physical exercise versus WLC	3 h/week \times 8 weeks	Pre-training, post-training	Coping subscales of OSI (social support, task strategies, logic, home/work relations, time management, involvement)	Significant post-intervention increases in social support, task strategies, home/work relations, and involvement, and significant decreases in time management
Ranta, 2009* (low)	Police (80) India	MI versus RI	3 \times 1 h group sessions + homework versus 1 \times 1 h session	Pre-training, post-training	Coping Behaviour Questionnaire	Significant post-intervention increase in coping in MI group only. SDs not provided, author contacted
Skeffington et al., 2016 (moderate-high)	Firefighters (75) Australia	MAPS versus TAU	1 h/week \times 4 weeks group sessions	Pre-training, 6 months, 12 months follow-up	Brief COPE adaptive (active coping, planning, positive reframing, acceptance, humour, religion, emotional support, instrumental support) and maladaptive subscales (self-distraction, denial, venting, substance use, behavioural disengagement, self-blame); SSQN	Significant decrease in adaptive and maladaptive coping in both groups at 12-month follow-up. Sustained increase in perceived social support among the control group only

TABLE 2 (Continued)

Study (quality)	Population (n) country	Intervention description	Intervention duration	Evaluations	Outcomes	Results
Tuckey & Scott, 2014 (moderate-high)	Volunteer firefighters (67) Australia	CISD versus stress management education versus screening only (no treatment control)	90 min group CISD and education sessions within three days of PPTe	Pre-training, 1 month follow-up	Past week alcohol consumption	Controlling for pre-intervention scores, CISD was associated with significantly less alcohol consumption one-month post-intervention relative to the screening only condition, but not the education group
Within-subject intervention studies						
Anshel & Brinthaup, 2014 (moderate-high)	Police (11) USA	Approach-avoidance coping intervention	2 h seminar + 10 week intervention + 2 × 1 h coaching sessions	Pre-training, post- training	CSAS (approach and avoidance subscales)	No significant differences in either approach or avoidant coping post-intervention
Within-subject observational studies						
Craun et al., 2014* (moderate-low)	Deputy marshalls (747) USA	SOICs versus Marshalls from other departments	N/A	Baseline, 14 months, 28 months follow- up	COPE Scale (active, positive reinterpretation, social support, denial, planning subscales); separate self- reported scales for supervisory and colleague support, alcohol and tobacco use; physical exercise (IPAQ)	Increased social support coping, moderate to high physical activity, and self-reported support from supervisors and coworkers related to lower STS. Denial and increases in past-year alcohol and tobacco were related to higher STS. Demographic variables (i.e., having children) did not influence STS. Ms and SDs are not provided for coping outcomes, author contacted.
de Terte et al., 2014* (moderate-low)	Police (176) New Zealand	N/A	N/A	Baseline (start of police training), 1- year, 10-years follow-up	BRCS, SSS supervisor, colleague, family subscales	Social support from colleagues predicted fewer PTSD symptoms and less psychological distress. Adaptive coping and support from colleagues predicted better physical health. Coping was evaluated at 10years follow-up only.

(Continues)

TABLE 2 (Continued)

Study (quality)	Population (n) country	Intervention description	Intervention duration	Evaluations	Outcomes	Results
Dougall et al., 2001 (moderate-low)	Rescue and recovery workers (159) USA	N/A	N/A	4–8 weeks, 6 months, 9 months, 12 months follow- ups	WCQ (problem-focused, wishful thinking, seeking social support, self-blame, avoidance subscales); SSQ; LOT	Wishful thinking decreased at 12 mons, while problem-focused and avoidant coping increased at 9 and 12 months. Increased optimism predicted greater problem-focused and social support coping and less wishful thinking and avoidance coping, but relationships were not stable over time. Perceived social support was related to optimism and seeking social support as a coping behaviour.
Ms and SDs are not reported for coping or social support outcome measures, the corresponding author deceased.						
Iwasaki et al., 2002 (moderate-high)	Police and emergency response services (200) Canada	N/A	N/A	Baseline, 1 months, 2 months follow- up	LCBS; LCSS; COPE Scale (problem-focused, emotion- focused, social support, acceptance, restraint, positive reframing, disengagement subscales); immediate coping outcomes (coping effectiveness, satisfaction, stress reduction)	Leisure coping positively related to short- and long-term coping, stress, and physical and mental health outcomes above and beyond general coping strategies
Wasserman et al., 2019 (moderate-low)	Police officers (120) South Africa	N/A	N/A	Baseline (start of police training), 6- month, 2-year follow-up	WCQ (confrontive coping, distancing, self-controlling, seeking social support, accepting responsibility, escape avoidance, planful problem-solving, and positive reappraisal subscales)	Planful problem-solving, positive reappraisal and confrontive coping strategies used more relative to seeking social support, escape avoidance, and accepting responsibility. Significant reductions in accepting responsibility and confrontive coping, and increases in planful problem- solving, positive reappraisal, and escape avoidance over time. SDs not provided, author contacted.

TABLE 2 (Continued)

Study (quality)	Population (n) country	Intervention description	Intervention duration	Evaluations	Outcomes	Results
Williams et al., 2010 (moderate-low)	Police officers (60) Australia	N/A	N/A	Baseline, 10-12-month follow-up	AAQ (experiential avoidance), WBSI (thought suppression)	No differences in avoidance patterns at follow-up, but increases in depressive symptoms. Thought suppression scores at baseline predicted depression at follow-up.

Note: Studies not included in meta-analyses ($n = 3$) are marked with an asterisk (*) next to the authors' names. Studies are presented by study design: randomized control trials (RCTs, $n = 6$), within-subject interventions ($n = 1$), and within-subject observational studies ($n = 6$).

Abbreviations: AAQ, Acceptance and Action Questionnaire; BRCS, Brief Resilience Coping Scale; CISD, critical incident stress debriefing; COPE, coping orientation for problem experiences; CSAS, coping style for acute stress; GNGO, governmental and non-governmental organizations; IPAQ, International Physical Activity Questionnaire; LCBS, Leisure Coping Beliefs Scale; LCSS, Leisure Coping Strategy Scale; LOT, Life Orientation Test; M, mean; MAPS, mental agility and psychological strength; MI, Multidimensional Stress Management; Coping, and Relaxation Intervention; N/A, not applicable; NET, narrative exposure therapy; OSI, occupational stress indicator; PTSD, posttraumatic stress disorder; RI, Relaxation Only Intervention; SD, standard deviation; SOLIC, sex offender investigation coordinator; SSQN, Social Support Questionnaire—short form; SSQ, Social Support Questionnaire; SSS, Social Support Scale; STS, secondary traumatic stress; TAU, training as usual; WBSI, White Bear Suppression Inventory; WCQ, Ways of Coping Questionnaire; WLC, waitlist control

Of the 13 eligible studies, three were excluded from the meta-analysis for failing to report the means or standard deviations for their coping outcome measures (Craun et al., 2014; Ranta, 2009), for measuring coping at only one time point (de Terte et al., 2014), and for reporting only a global composite coping score (i.e., no separation of approach and avoidant subscales; Ranta, 2009). Requests for missing data were unanswered at the time of submitting the current review. Ultimately, ten studies were included in a quantitative meta-analysis.

4.2 | Meta-analysis of approach coping

While measures of approach coping appeared to improve at follow-up, the improvement was a small effect and did not reach statistical significance ($d = 0.18$, 95% CI $[-0.05, 0.18]$, $k = 10$ studies, $I^2 = 0\%$; Figure 2). There were no significant subgroup effects noted by study design, PSP category, or intervention category. Meta-regression analyses for the impact of age, sex distribution, or time (time-since event, duration of treatment, time to follow up) on study effect sizes were not significant.

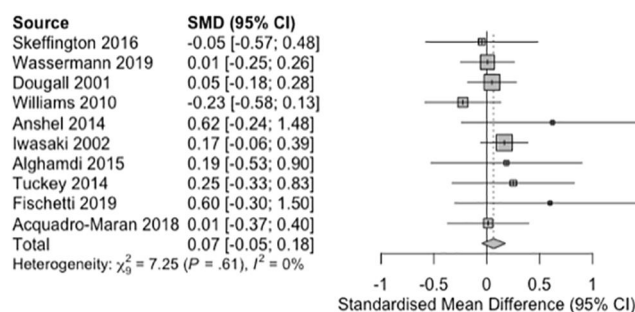


FIGURE 2 Forest plot for random-effects meta-analysis on longitudinal approach coping among public safety personnel. CI, confidence interval; SMD, standardized mean difference

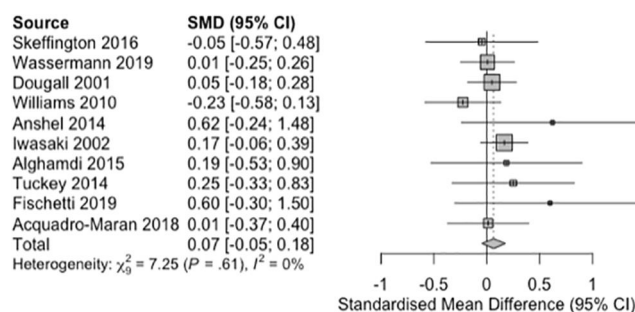


FIGURE 3 Forest plot for random-effects meta-analysis on longitudinal avoidant coping among public safety personnel. SMD = standardized mean difference; CI, confidence interval; SMD, standardized mean difference

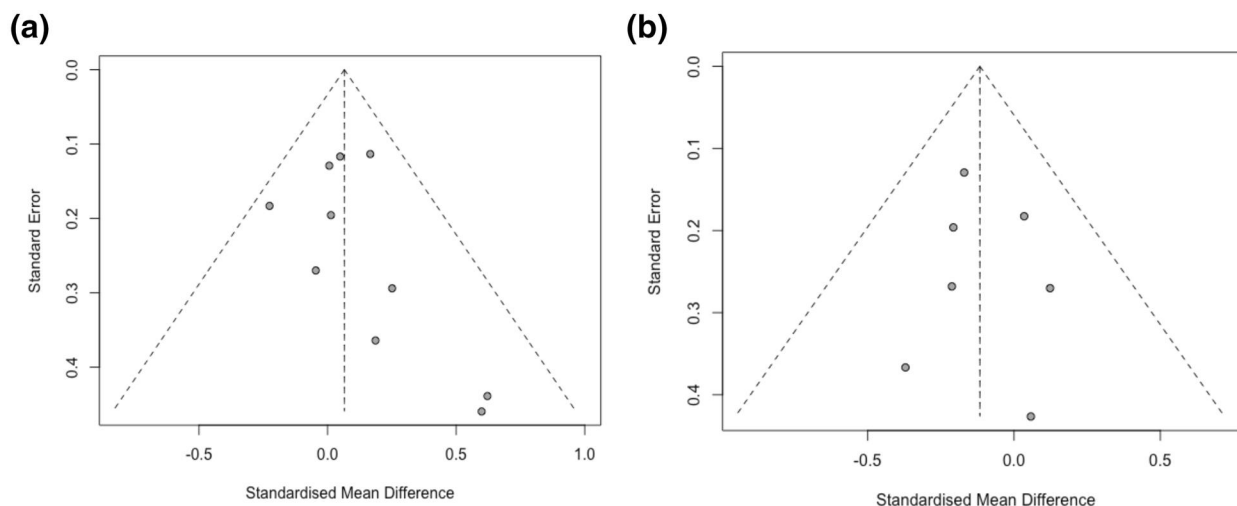


FIGURE 4 Funnel plot for publication bias in (a) approach coping and (b) avoidant coping meta-analyses

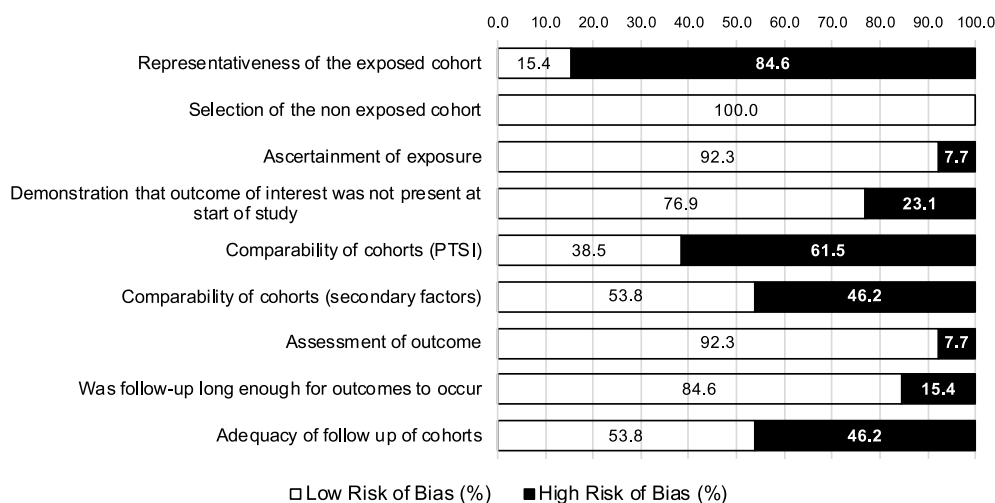


FIGURE 5 Quality assessment using the Newcastle-Ottawa Scale. Full sample ($n = 13$ studies) summary of the strength of evidence from the systematic review

4.3 | Meta-analysis of avoidant coping

While avoidant coping measures appeared to improve at follow-up, the improvement was also a small effect and did not reach statistical significance ($d = -0.12$, 95% CI $[-0.27, 0.04]$, $k = 7$ studies, $I^2 = 0\%$; Figure 3). There were no significant subgroup effects noted by study design, PSP category, or intervention category. Meta-regression analyses for the impact of age, sex distribution, or time on study effect sizes were not significant.

4.4 | Publication bias

There was no evidence of publication bias for either approach or avoidant coping (Figure 4).

4.5 | Quality assessment

Quality assessment ratings for all studies in the current systematic review are illustrated in Figure 5, and individual study ratings are

TABLE 3 Individual quality assessment ratings ($n = 13$)

Study	Representativeness of the exposed cohort	Selection of non-exposed	Ascertainment of exposure	Primary outcome not present at baseline	Comparability of cohorts (I)	Comparability of cohorts (II)	Assessment of outcome	Duration of follow-up	Adequacy of follow-up
Acquadro Maran et al., 2018	High	Low	Low	Low	High	High	Low	Low	Low
Alghamdi et al., 2015	High	Low	Low	Low	Low	Low	Low	Low	High
Anshel & Brinthaup, 2014	High	Low	Low	Low	High	Low	Low	Low	Low
Craun et al., 2014	High	Low	Low	High	High	Low	Low	Low	Low
de Terte et al., 2014	High	Low	Low	High	Low	High	Low	Low	High
Dougall et al., 2001	High	Low	Low	High	High	Low	Low	Low	Low
Fischetti et al., 2019	High	Low	Low	Low	High	High	Low	High	Low
Iwasaki et al., 2002	High	Low	Low	Low	Low	Low	Low	Low	High
Ranta, 2009	High	Low	High	Low	High	High	Low	High	High
Skeffington et al., 2016	Low	Low	Low	Low	Low	Low	Low	Low	High
Tuckey & Scott, 2014	Low	Low	Low	Low	Low	Low	High	Low	Low
Wasserman et al., 2019	High	Low	Low	Low	High	High	Low	Low	High
Williams et al., 2010	High	Low	Low	Low	High	High	Low	Low	Low

reported in Table 3. Overall, no studies were of 'high quality'. Five studies were 'moderate to high quality' (Alghamdi et al., 2015; Anshel & Brinthaup, 2014; Iwasaki et al., 2002; Skeffington et al., 2016; Tuckey & Scott, 2014), seven were of 'moderate to low quality' (Acquadro Maran et al., 2018; Craun et al., 2014; de Terte et al., 2014; Dougall et al., 2001; Fischetti et al., 2019; Wasserman et al., 2019; Williams et al., 2010), and one study was 'low quality' (Ranta, 2009).

4.5.1 | Selection

Regarding individual study quality assessment criteria, all but two (Skeffington et al., 2016; Tuckey & Scott, 2014) of the studies included in the current review did not demonstrate that their sample was representative of the larger population of workers concerning demographic variables such as sex, average age, or years of service, limiting the generalizability of their results. All studies were rated at a low risk of bias regarding selection of the non-exposed cohort, which was either randomly chosen from the same population in the case of RCTs, or not applicable for single-sample intervention and observational study designs. All but one study (Ranta, 2009) provided a clear indication that participants were exposed to (or participated in) a PTSD intervention, or PPTs as measured by traumatic exposure questionnaires or active duty fieldwork preceding each follow-up evaluation. Three studies received a high-risk rating for failing to provide baseline scores to demonstrate that the outcome of interest (i.e., high levels of adaptive coping or low levels of avoidant coping) was not present at the start of the study (Craun et al., 2014; de Terte et al., 2014; Dougall et al., 2001).

4.5.2 | Comparability

Most studies (eight of 13) were deemed at a high risk of bias for failing to control for, or account for, the most crucial factor in the study design or analysis—the presence of a PTSD or diagnosable mental disorder at the time of the study—which would substantially bias the outcome of intervention (i.e., evaluating the effectiveness of a PTSD mitigation service) or observational studies (i.e., changes in coping over time or relationship to other psychological or health factors). Similarly, six out of 13 were at a high risk of bias for failing to control for an additional factor in their study design or analysis, such as participant sex, age, or years of service, which have been statistically significantly associated with PSP mental health outcomes (Carleton et al., 2018a).

4.5.3 | Outcome

All but one study was rated at low risk of bias regarding assessing study outcomes based on empirically validated self-report coping tools. Tuckey and Scott (2014) received a high risk of bias rating for using revised versions of previously validated measures and

unvalidated self-report measures of past week alcohol consumption, which could be prone to individual reporting biases (e.g., memory errors, desire to respond in a favourable way that minimized stigmatized attitudes or behaviours). Except for two RCTs (Fischetti et al., 2019; Ranta, 2009), all remaining studies provided sufficient time following a PPT or participation in a PTSD mitigation service or program before collecting outcome measures, resulting in low risk of bias ratings based on time. There were six out of 13 studies that were rated as high risk for failing to provide an analysis of baseline measures or demographic variables between participants lost at follow-up and those who completed follow-up measures; however, Tuckey and Scott (2014) did apply appropriate statistical analyses (i.e., multilevel hierarchical modelling) to account for post-intervention attrition.

5 | DISCUSSION

Amplified by the global coronavirus pandemic, identifying discrete behaviours, skills, and strategies to cope with trauma to reduce adverse health outcomes is more urgent than ever. The current systematic review identified 13 repeated-measures studies of approach and avoidant coping among 1854 police officers, firefighters, and rescue and recovery workers. Effect sizes (Cohen's *d*) at follow-up were described in 11 studies, and meta-analyses revealed small ($d < 0.2$) but non-significant improvements in approach and avoidant coping across studies. Findings were affected by significant heterogeneity in study design, exposure to potentially traumatic events, PSP population, outcome measures and definitions of coping, intervention and follow-up types and durations.

To that end, extant literature is unclear regarding the long-term effectiveness of various coping strategies employed by PSP following exposure to work-related PPT. The current findings can inform the development and evaluation of organizational training programs that effectively promote sustained adaptive coping for PSP and mitigate PTSDs.

Although the overall risk of publication bias was deemed small, the quality of the individual studies was low to moderate. Most studies were at a high risk of reporting bias concerning evaluation of the representativeness of study samples to the broader population. More than half of the studies also failed to assess or control for the presence of a PTSD or mental disorder, which would likely impact coping outcomes and confound investigations of PTSD program effectiveness. Six of the 13 studies also failed to account for secondary factors in their analyses that would affect coping (i.e., sex, years of service, exposure to occupational PPTs), and six studies failed to compare baseline or demographic data between participants lost to follow-up and those retained in the study.

Evaluation of study outcomes with quantitative meta-analyses provides modest evidence for improvements in aggregated approach ($n = 10$) and avoidant ($n = 7$) coping measures at follow-up (see Appendix A), regardless of whether participants were exposed to a PTSD mitigation intervention program ($n = 7$) or part of an

observational study ($n = 4$). However, meta-analytic results did not reach statistical significance for either approach or avoidant coping. Consistent with previous literature on post-training improvements in PTSD among PSP (Beshai & Carleton, 2016; Carleton et al., 2019b; McCreary, 2019), improvements in coping skills have small effect sizes and diminish over time. Further, most PSP coping studies do not measure coping as the primary study outcome, but more commonly include coping as an additional measure of broader psychological health and functioning. The vast majority of relevant investigations yielded by our systematic literature review ($n = 227$, see Figure 1 and Table 1 for eligibility criteria) included qualitative or cross-sectional studies (i.e., evaluating coping and other measures at a single point in time). Of these studies, coping was often investigated as a mediating or moderating variable between psychological outcomes and other factors, including occupational stressors, PTSD symptoms, and burnout (Angelo & Chambel, 2014; Chang et al., 2008; Isenhardt et al., 2019; Ryu et al., 2020; Violanti et al., 2018). For the current sample of eligible longitudinal studies of PSP coping (Table 2, $n = 13$), seven investigated the impact of an intervention on coping. Only one of these interventions was explicitly aimed at improving coping (Anshel & Brinthaup, 2014), four aimed to train various forms of stress management, emotion regulation, or psychological strength (Alghamdi et al., 2015; Ranta, 2009; Skeffington et al., 2016; Tuckey & Scott, 2014), and two aimed to improve psychological functioning via physical exercise and strength conditioning (Acquadro Maran et al., 2018; Fischetti et al., 2019). Coping was the primary outcome measure in all but two investigations, which primarily evaluated post-training improvements in PTSD and other PTSD symptoms (Alghamdi et al., 2015; Tuckey & Scott, 2014).

The literature identified presently lacks a clear, unified definition of coping, which is also not a clinically validated construct for PTSDs (CIPSRT, 2020). Accordingly, we found significant inconsistency in coping outcome measures used across studies and inconsistent aggregation of various subscales to operationalize approach and avoidant coping (see Appendix A). The Brief COPE (Carver, 1997) was used most often (three of 13), with distinct (Acquadro Maran et al., 2018) and aggregated subscales defined as both 'active' and 'passive' (Alghamdi et al., 2015) or 'adaptive' and 'maladaptive' (Skeffington et al., 2016). Different subscales of the Coping Orientation for Problem Experiences (COPE, Carver et al., 1989) scale were used in two studies (Craun et al., 2014; Iwasaki et al., 2002). However, Craun et al. (2014) failed to report the means and standard deviations for their coping outcomes and were thus excluded from the present meta-analysis. Therefore, inconsistencies in outcome measures and data reporting preclude a more thorough analysis of long-term changes in coping among PSP. This finding is also consistent with a longstanding controversy in coping measurement discussed by Coyne and Racioppo (2000), who contrast differences between descriptive studies that employ coping checklists from interventions that aim to improve psychological functioning and adaptation by enhancing coping. While measuring coping in the latter context provides evidence of an intervention's efficacy, these are often potentially misleading correlational studies. To that end, there

is a need to understand crucial ingredients, mechanisms of change, or barriers to maintaining post-intervention gains in psychological functioning (Anderson et al., 2020) and cross-fertilizing insights from qualitative and quantitative studies (Coyne & Racioppo, 2000).

For the current review and analysis, we operationalized approach coping as all of the positive, adaptive behaviours, skills, and strategies that individuals can employ to improve psychological health and functioning. Avoidant coping was operationalized by negative, maladaptive behaviours, skills, and strategies that can degrade psychological health and functioning (Anshel, 2000; Carver & Connor-Smith, 2010; Moos & Schaefer, 1993; Skinner et al., 2003; see Appendix A). Subscales representing approach coping strategies are far more varied than avoidant coping and range from cognitive and emotional processing strategies (e.g., positive reframing, acceptance, emotion- and problem-focused coping) to concrete behaviours related to occupational stress (Occupational Stress Indicator coping subscale, Cooper et al., 1988). Iwasaki presents a series of studies examining the role of leisure in promoting adaptive coping, focussing on PSP (Iwasaki, 2003; Iwasaki et al., 2002, 2005). Accordingly, approach coping strategies are rooted in various theoretical frameworks, further complicating the identification of a unified definition. The inconsistent evaluation of specific approach coping strategies also precludes the identification of an optimal strategy or behaviour that best promotes long-term psychological health and mitigates PTSDs among PSP.

In contrast, avoidant coping strategies are more narrowly operationalized by negative, maladaptive behaviours (e.g., withdrawal, avoidance, disengagement, venting, thought suppression) and strategies (e.g., self-blame, denial, self-distraction). In the general population, higher avoidant coping levels predict increased risk of self-harm, suicidal ideation, and higher alcohol consumption (Nielsen et al., 2016; Wills & Hirsky, 1996; Woodhead et al., 2014). Among PSP, substance abuse has been reported as a common form of coping with occupational PPTs (Martin et al., 2017; Ménard & Arter, 2013), with an estimated 5.9% of Canadian PSP surveyed by Carleton et al. (2018a) screening positive for risky alcohol consumption as evaluated by the Alcohol Use Disorders Identification Test (AUDIT, Babor et al., 2001). Di Nota et al. (2020) also reveal that risky alcohol use increases the risk for suicidal ideation among police when controlling for age and sex. Four studies in the current review evaluated substance use but aggregated this outcome with other avoidant subscales (Acquadro Maran et al., 2018; Alghamdi et al., 2015; Skeffington et al., 2016) or failed to evaluate substance abuse with empirically validated screening tools like the AUDIT (Tuckey & Scott, 2014). Alcohol or substance abuse has been operationalized as a PTSD (CIPSRT, 2020), a form of maladaptive coping (Brief COPE subscale, Carver, 1997), and is a diagnosable disorder (ICD-10: World Health Organization, 1993; DSM-5: American Psychiatric Association [APA], 2013). As with other coping strategies like social support, these outcomes possess their own stand-alone definitions and theoretical frameworks. This range of operationalization further contributes to the lack of a unified definition of coping.

Social support is reported in the current studies as both an approach coping subscale (COPE) and a distinct outcome measured by various validated assessment scales (e.g., Social Support Scale by Caplan et al., 1975; Social Support Questionnaire—Short Form by Sarason et al., 1987). Social support is theoretically and conceptually similar to approach coping, such that increased support-seeking and camaraderie buffers the adverse psychological and physical effects of PPTE (Charuvastra & Cloitre, 2008). However, occupational cultures in the public safety professions often stigmatize emotional support seeking (Britt & McFadden, 2012; Ricciardelli, 2018). There is promising evidence that resilience and mental health training can diminish stigma to a greater extent than PTSI symptoms (Carleton et al., 2019b). Both perceived and actual social support promote PSP's mental health outcomes (Prati & Pietrantonio, 2010). PSP reportedly seek social help from family and friends relatively more than supervisors or seek professional assistance (Carleton et al., 2019b). Therefore, the development of resources to support PSP spouses, families, and Allies would also indirectly contribute to the holistic promotion of PSP wellbeing.

As there were no clearly effective strategies to enhance coping strategies in any PSP population, the review findings suggest that this remains a much-needed area for future research. Limited and inconsistent study designs preclude more conclusive recommendations for specific coping strategies or training approaches. Future investigations of coping among PSP and evaluations of intervention program effectiveness should consistently operationalize and evaluate PTSI and coping outcomes to further clarify the relationships between them.

5.1 | Limitations

Study limitations may include the search strategy and criteria process (Table 1), which restricted studies for inclusion to English- and French-language studies published after 2000 from five indexed electronic databases. Despite a relatively high number of search results ($n = 6769$), less than 1% of studies yielded by the current systematic literature review directly evaluated coping in PSP at more than one time point. Accordingly, the main limitation of the present meta-analysis is the high heterogeneity of outcome measures and operational definitions of coping across studies (see Appendix A).

The design of eligible studies was also highly variable and limited, with just over half of studies investigating the long-term effects of a psychological intervention or training program compared to the remaining longitudinal within-subject observational studies. Geographical variability of study samples also makes generalizability difficult, as PPTEs and coping strategies used in one political, cultural, social, economic, and epidemiological context may not be relevant, applicable, or practical elsewhere. Nevertheless, the substantial impact of PPTEs on PSP health and functioning is broadly accepted. There is a need to consider and identify effective coping strategies to mitigate PTSIs for these at-risk workers to minimize personal, social, and organizational costs.

Ultimately, another significant limitation of this review was the low yield of studies, which required collapsing of several moderators of coping in order to facilitate a meta-analysis. For example, while pooling all the follow-up periods made computational sense given the low study yield, this impacted the interpretation of the findings. Pooling all follow-up times is especially problematic because this review aimed to examine longitudinal data, and this strategy means that the meaningful variability in the longitudinal data is lost. To that end, post-hoc meta-regression analyses by time-since event, duration of treatment, and time to follow-up were conducted and did not identify any statistically significant association with either adaptive or approach coping. As coping to a specific event would be predicted to decrease as time lapsed, the time of coping measurement is important—and may have been overlooked by our decision to pool follow-up outcomes.

Subgroup and meta-regression analyses were performed to examine the impact of some key moderators on the effectiveness of coping, such as the type of coping scale used, the time since the stressor, intervention length, and time since intervention. However, these analyses were compromised by the low study yield for any individual moderator variable. For example, only a few of the studies involved a referent event (e.g., exposure to a critical incident), while most others measured generalized coping. We also considered multiple public safety personnel professions (e.g., firefighters, police officers, peacekeepers). Similarly, multiple coping scales were pooled across studies—with some empirically derived, others theoretically derived, and a few were not specifically designed to measure coping. The meta-analysis performed used a SMD, which allows studies to be pooled that measure the same outcome (e.g., 'coping') but in different ways. With that said, there is still a significant amount of residual heterogeneity in terms of these measurements, and statistical accommodations can only adjust for so much. Hence, it is possible that stronger effect sizes may be found based on the type of coping scale, referent event, time since the traumatic exposure, and the intervention length and follow-up duration; however, the present meta-analysis may have been underpowered to find these differences in the present study. Finally, the decision to categorize coping as 'approach' or 'avoidant' should not be thought of as 'positive' or 'negative'. As coping strategies are not inherently good or bad, the context in which these strategies are used is what is most important. For instance, problem-focused coping may worsen some outcomes, while denial may improve some results (at least in the short-term).

For these reasons, there is a need to standardize future studies that investigate and seek to improve PSP's long-term coping outcomes.

6 | CONCLUSIONS

There is an urgent need to identify effective and adaptive coping strategies that can effectively mitigate the adverse psychological effects of traumatic occupational exposures, especially during the current coronavirus pandemic. The current systematic review and

meta-analysis yielded 13 relevant peer-reviewed studies that measured PSP coping at more than one time point. Significant heterogeneity in study design, duration, coping measures, and strength of research evidence was found across studies. Consistent with previous evidence, improvements in approach and avoidant coping outcomes were of small and non-significant effects, suggesting that the utilization of effective coping strategies and associated psychological benefits are short-lived. Through the compilation of various definitions of coping and identification of practical study limitations, the current synthesis can inform future high-quality research in PSP populations.

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CONFLICT OF INTEREST

The authors have declared that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

Study conception and design: Gregory S. Anderson, Dianne Groll; Data acquisition: Paula M. Di Nota; Data analysis and interpretation: Paula M. Di Nota, Emily Kasurak, Anees Bahji; Manuscript writing: Paula M. Di Nota, Emily Kasurak, Anees Bahji; Manuscript revisions (theoretical and technical): Dianne Groll, Gregory S. Anderson.

DATA AVAILABILITY STATEMENT

This review used secondary data which is freely available within publications reviewed. For more information, please contact the authors.

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APPENDIX A Meta-analytic outcomes. List of coping outcome categories and specific measures included in the meta-analysis

Outcome category	Specific measures included	Direction
Approach coping	<ol style="list-style-type: none"> 1. Brief COPE: Planning, religion, positive reframing, active coping, emotional support, instrumental support, humour, acceptance subscales 2. Coping orientation for problem experiences (COPE): Problem-focused, social support, emotion-focused, acceptance, restraint, positive reframing subscales 3. Ways of coping Questionnaire: Seeking social support, planful problem solving, positive reappraisal, accepting responsibility 4. Coping Style for acute Stress: Approach subscale 5. Life orientation test 6. Leisure coping beliefs Scale 7. Leisure coping Strategy Scale 8. Social Support Scale (Jaber, 2012): Family, friends, GNGO subscales 9. Social Support Questionnaire—Short form (Sarason et al., 1987) 10. Occupational Stress Indicator coping subscales: Social support, task strategies, logic, home/work relations, time management, involvement 	Higher is better
Avoidant coping	<ol style="list-style-type: none"> 1. Brief COPE: Behavioural disengagement, substance abuse, self-blame, denial, self-distraction, venting subscales 2. Coping orientation for problem experiences (COPE): Disengagement subscale 3. Ways of coping Questionnaire: Confrontive coping, escape-avoidance 4. Coping Style for acute Stress: Avoidance subscale 5. Acceptance and action Questionnaire 6. White bear Suppression Inventory 7. Past week alcohol consumption 	Lower is better