

# Effectiveness of psychological skills training for police personnel: a meta-analysis

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## ABSTRACT

There has been an increasing interest in primary prevention programmes developed to improve police officers' mental health. This meta-analysis synthesised the existing findings on psychological skills training for police personnel including resilience training and mindfulness-based training. Particularly, this study systematically assessed the effectiveness of training programmes on mental health outcomes including resilience, depression, anxiety and perceived stress. A comprehensive search of EBSCO, ProQuest and Web of Science was conducted for studies written in English from 1999 to 2022. Two independent researchers screened 5604 studies. Eligible studies are intervention studies with controlled trials that involved training programmes to improve participants' mental health and reported at least one of the following outcomes: resilience, depression, anxiety and perceived stress. The meta-analysis estimated standardised mean differences (SMDs) for each of the four outcomes. A total of 12 studies, involving 2298 police personnel from 8 countries, met the criteria for inclusion and quality assessment. The training programmes of the eligible studies varied in training approaches, duration, total sessions and follow-up periods. The results suggest that training programmes have a statistically significant moderate effect on depression (SMD=-0.47, 95% CI=-0.73 to -0.22) and anxiety (SMD=-0.40, 95% CI=-0.73 to -0.06), while the effects on resilience (SMD=1.03, 95% CI=-0.36 to 2.41) and perceived stress (SMD=-1.03, 95% CI=-2.15 to 0.08) are not statistically significant. This study highlights the role of primary prevention approaches in supporting officers' mental health by showing that training programmes are effective in mitigating the risk of depression and anxiety.

## INTRODUCTION

Constant exposure to critical incidents is an integral part of police work. Critical incidents may involve primary exposure, such as being attacked in the line of duty, or secondary exposure, such as encountering an abused child or a sexually assaulted victim.<sup>1</sup> These traumatic experiences may also involve a loved one being threatened or a colleague committing suicide.<sup>1,2</sup> The cumulative exposure to these incidents over the course of an officer's career has its cost. Research has shown that police officers face an elevated risk of developing mental health problems such as post-traumatic stress disorder (PTSD), anxiety, depression or suicide ideation.<sup>3-5</sup>

While an extensive body of research examines the impacts of these job-related stressors inherent in law enforcement, this line of research mainly revolves around the risk factors of health.<sup>6</sup> Scholarship on

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Police officers are at elevated risk of developing mental health problems such as depression, anxiety, post-traumatic stress disorder and suicide ideation.
- ⇒ There has been an increasing body of evaluation research on the psychological skills training programmes implemented in police agencies worldwide, but the findings are mixed.

## WHAT THIS STUDY ADDS

- ⇒ This study synthesised recent literature on psychological skills training for police personnel including resilience training and mindfulness training.
- ⇒ The results suggest that psychological skills training programmes can potentially reduce the risk of depression and anxiety among police personnel.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ This study highlights the importance of primary prevention in enhancing police officers' mental health through training and the need for delivering training programmes in police agencies and academies.

positive psychology, on the other hand, focuses more on identifying and building mental strengths and assets as opposed to addressing weaknesses, problems and illness.<sup>7</sup> The emphasis on the protective factors is important for primary prevention. The emergence of positive psychology also shapes the field of occupational health, which includes many preventive approaches to enhancing workplace mental health in law enforcement around the world.<sup>8-12</sup>

Over the past two decades, one of the most common primary prevention interventions developed for police officers has been referred to as 'resiliency' or 'mindfulness' training.<sup>13,14</sup> These programmes focus on strengthening officers' psychological skills through training to proactively protect them against the potential risk exposure at work. Resilience plays a pivotal role in this line of research as police personnel are frequently exposed to stressful circumstances and potentially traumatic events.<sup>15,16</sup> How to encounter stressors without significant negative disruptions in professional functioning, therefore, is central to policing. Indeed, there has been an increase in the effort to implement these primary prevention training programmes in law enforcement to foster officers'



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resilience and to reduce the risk of developing physical and mental health problems in recent years.<sup>17–21</sup>

Prior intervention studies with controlled trials examining psychological skills training, however, have demonstrated mixed results on a variety of mental health outcomes. Some studies have revealed that resilience training, positive psychology-based training or stress inoculation training programmes are effective in enhancing resilience<sup>8,9,22</sup> and job satisfaction<sup>9</sup> and reducing perceived stress,<sup>9,18,22–24</sup> depression,<sup>8,9,23</sup> anxiety<sup>8,9</sup> and negative emotions.<sup>8,18,23</sup> Despite these promising results, there were also findings showing that the training programmes did not yield significant effects on resilience,<sup>11,25</sup> anger,<sup>23,24</sup> perceived stress,<sup>25</sup> positive emotions,<sup>23</sup> depression,<sup>11,24,25</sup> anxiety<sup>11,23–25</sup> and PTSD.<sup>25</sup> Likewise, there is evidence on the effectiveness of mindfulness-based training in enhancing resilience<sup>26</sup> and life satisfaction<sup>26</sup> and reducing depression,<sup>12,27</sup> anxiety,<sup>12,27</sup> PTSD,<sup>10</sup> perceived stress,<sup>27,28</sup> sleep problems,<sup>10,27,28</sup> aggression<sup>28</sup> and burn-out.<sup>27,28</sup> However, there were null results for similar outcome measures such as resilience,<sup>28</sup> perceived stress,<sup>10</sup> depression<sup>28</sup> and anxiety.<sup>28</sup>

Though an earlier meta-analysis of stress interventions for police officers did not find significant effects on psychological outcomes,<sup>29</sup> this study and another systematic review cautioned against drawing conclusions and pointed out the need for more large-scale, well-designed and rigorous evaluation studies.<sup>29,30</sup> As there has been increasing attention given to promoting police officers' mental health through training programmes in recent years, a synthesis of empirical evidence on existing training programmes is necessary to better understand whether these practices are evidence-based and whether police agencies should invest in these preventive approaches universally.

There were some limitations in previous reviews. Specifically, most reviews included a wide variety of interventions, which can make it difficult to understand and interpret the pooled effects or results. For instance, in a meta-analysis of stress interventions for police officers,<sup>29</sup> the interventions included the components of psychoeducation, physical/fitness training, dietary/nutrition programmes, brief eclectic psychotherapy, wellness counselling, eye movement desensitisation and reprocessing, visuo-motor behaviour rehearsal and writing interventions. The other review also included both primary prevention and secondary prevention programmes for law enforcement officers including social skills training, mental imaging training, fitness programmes, visuo-motor behaviour rehearsal and counselling group sessions.<sup>30</sup> Even if the analysis shows promise, it is unclear which programmes or approaches work when primary, secondary or even tertiary prevention interventions were analysed together. Besides, the other issue is combining different outcome measures to estimate the effect sizes. In the meta-analysis mentioned above,<sup>29</sup> the effect of programmes on the psychological outcome was estimated based on the combined effects on stress, burn-out, mood disturbance, sleeping problems, anxiety, depression, psychological symptoms, PTSD and wellness across studies. Given that the programmes might not yield homogeneous treatment effects on different mental health outcomes, it does not make sense to analyse these mental health outcomes together. To address these gaps, this meta-analysis aimed to synthesise the available empirical evidence on the effectiveness of the psychological skills training for police personnel, particularly focusing on resilience, depression, anxiety and perceived stress.

## METHODS

### Search strategy

This meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and followed a predetermined but unregistered protocol. A total of 32 databases in EBSCO, ProQuest and Web of Science (see the entire list of the databases in online supplemental table S1) were searched. The systematic search was conducted in late January and early February 2023 using four sets of terms related to police/law enforcement, resilience or mental health, training or intervention and experiment or evaluation (see online supplemental table S1 for the full search strategy). We also searched references of prior reviews to identify studies that our keyword searches might have missed. The entire list of review studies can be found in online supplemental table S2.

### Eligibility

The inclusion criteria are as follows: (1) participants were drawn from selected or unselected samples of active-duty police officers, police recruits or civilian police personnel; (2) studies were controlled trials (either randomised controlled trials (RCTs) or non-RCTs) in which control groups did not receive any training during the evaluation period; (3) the interventions used were the training programmes aimed at enhancing officers' mental health; (4) evaluations reported results of at least one of the following outcomes: resilience, depression, anxiety and perceived stress; (5) studies had to be published between January 1999 and December 2022. Retrospective studies using ex post facto designs were excluded, as the contents of the trainings were unclear and likely to vary greatly across study subjects. There were no limitations on cultural range or country settings of the eligible studies, but the full text of the studies must be written in English. Publication types were not limited to peer-reviewed articles. Unpublished studies such as dissertations, master theses, conference papers, book chapters and governmental reports were included during the systematic search as well.

Eligibility of studies was determined by two independent researchers. Both researchers first screened all titles and abstracts identified from the systematic search with each study being coded as 'relevant', 'irrelevant' or 'maybe (relevant)'. The double screening process was facilitated using Abstrackr.<sup>31</sup> Both researchers then reviewed the full text of potentially eligible studies that were coded as 'relevant' or 'maybe'. Any disagreements were discussed and resolved together.

### Quality assessment

Methodological quality of the potentially eligible studies was assessed using the Downs and Black checklist.<sup>32</sup> In line with two previous reviews,<sup>33,34</sup> minor modifications were made to the scale for this study: the score of the item related to the statistical power was simplified to either zero or one based on whether there was sufficient power to detect significant effects. The maximum total score of the modified checklist was 28. The level of methodological quality was then grouped into four categories: excellent (26–28), good (20–25), fair (15–19) and poor (14 or less). Studies rated as 'poor' for the methodological quality assessment were excluded from the meta-analysis.

### Data analysis

A separate meta-analysis was conducted for each of the mental health outcomes including resilience, depression, anxiety and perceived stress. The effect measures were represented by the standardised mean differences (SMDs). Particularly, quantitative

findings regarding the means and SDs of these outcomes from both groups were extracted. We contacted the authors of the eligible studies if this information had not been reported. For studies including two treatment groups, the SMDs were calculated for each treatment group separately, contrasted with the control group. If a study assessed the outcomes multiple times, such as in post-training and follow-up, all relevant information was coded for analysis. To account for the baseline differences in quasi-experimental studies, we made adjustments by subtracting the pretest mean differences from the posttest mean differences while keeping the denominator the same (ie, the pooled SD of the posttest scores) (see the equation in online supplemental table S3). The SMDs were then corrected for the potential small sample bias by multiplying them by  $[1 - 3/(4N - 9)]$  where N is the total sample size.<sup>35</sup>

As most studies included more than one post-training assessment and several studies used different scales to measure the same outcomes, correlated effects models with robust variance estimation were used to estimate the mean effects sizes for the study outcomes.<sup>36</sup> All analyses were performed in R using the packages *robumeta* and *metafor*. In the meta-regression models with robust variance estimation, we used the default within-study effect size correlation ( $r=0.8$ ). We also checked the results with different values of  $r$  for the correlated effects meta-regression models using the function *sensitivity*. A subset of sensitivity analysis was conducted excluding quasi-experimental studies. To check for the publication bias, the trim-and-fill method and visual inspection of funnel plots were used for assessing asymmetry.

### Risk of bias assessment

To understand the potential risk of bias in our findings, the Effective Practice and Organisation of Care (EPOC) risk of bias tool was used to assess the studies included in the meta-analysis.<sup>37</sup> There are nine criteria: random sequence generation, allocation concealment, similar baseline outcome measurements, similar baseline characteristics, incomplete outcome data, blind outcome assessment, contamination, selective outcome reporting and other risks of bias. For other risks of bias, we focused particularly on low attendance rates of training and implementation infidelity. For each of the nine criteria, we coded for low risk, high risk or unclear risk.

### RESULTS

As shown in figure 1, a total of 5604 studies were identified from the systematic search after the removal of duplicates. The double screening process yielded a sample of 236 studies for the full-text review. A total of 14 eligible studies and one study identified from reference harvesting underwent quality assessment. Of the 15 studies, three quasi-experimental studies were rated as of poor methodological quality and were therefore excluded from the subsequent meta-analysis.<sup>11 25 38</sup> The quality scores of each of the assessed studies can be found in online supplemental table S4.

Table 1 shows the characteristics of the 12 studies included in the meta-analysis. More than two-thirds of the studies were published between 2017 and 2022. Four studies were conducted in the USA, five in Europe including Greece, Sweden, UK and Spain, one in Australia, one in India and one in Brazil. Though training programmes were based on different approaches including cognitive-behavioural therapy (CBT), mindfulness, acceptance and commitment therapy or the model of sense of coherence, most studies included training on relaxation techniques and adaptive coping strategies. Training sessions also

varied greatly, ranging from 3 to 20, and the total hours of training were between 6 and 30 hours. Regarding the methods, nine studies used RCTs, while three studies used quasi-experimental designs to evaluate the effectiveness of the training programmes. Eight studies included a waitlist control group. The 12 included studies involved a total of 2298 police personnel. The follow-up periods were between 1 and 12 months. In the methodological quality assessment, two studies were rated as 'good', and the remaining 10 studies were rated as 'fair'. The scales used for evaluating the outcomes of interest in each study are also included in table 1.

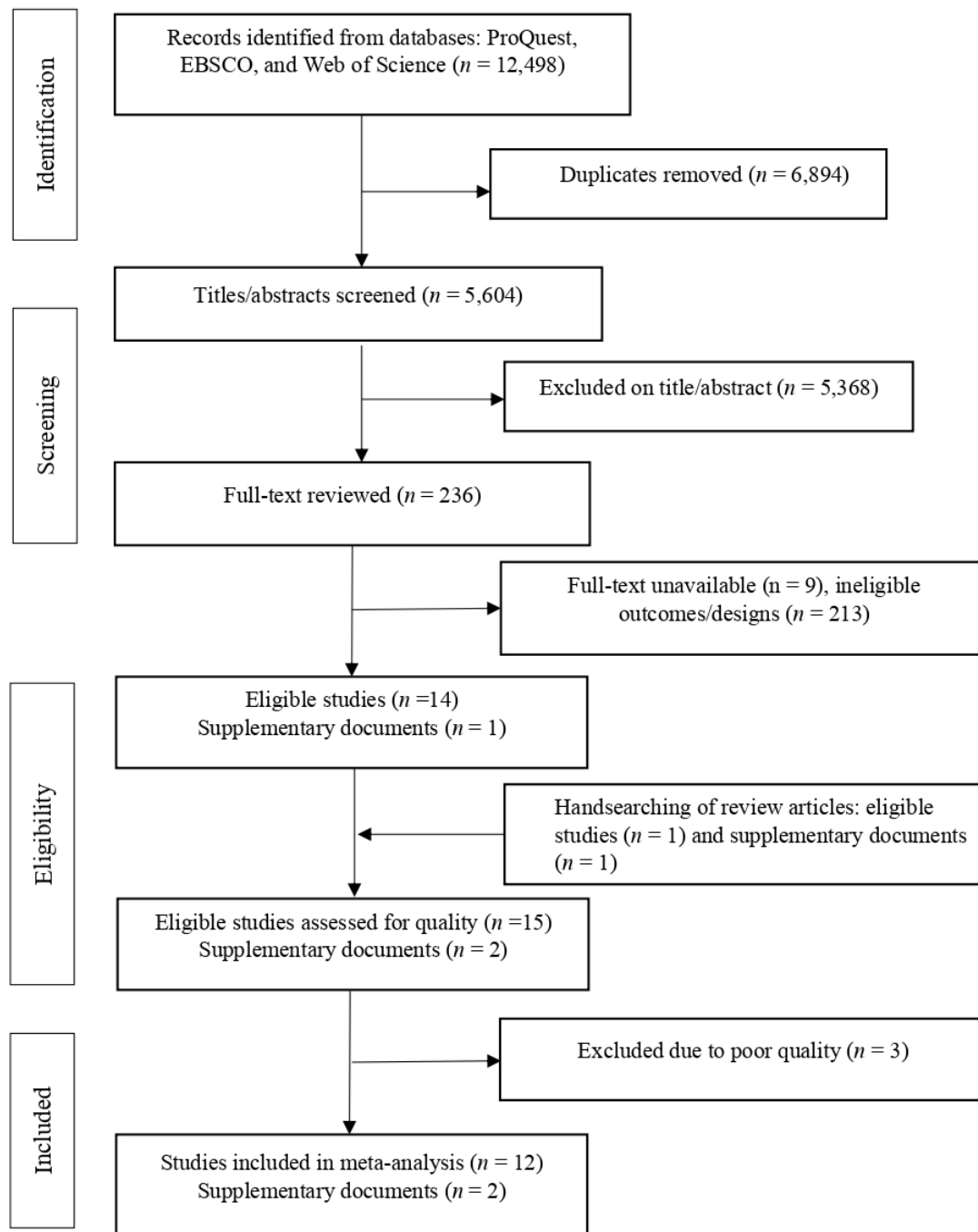
Effect sizes were calculated using means, SDs and sample sizes extracted from 10 studies<sup>8 9 12 18 22 24 25 27 28 39</sup> and obtained from the authors for 1 study.<sup>38</sup> The remaining study did not provide basic descriptive information but reported the effect sizes (d), which were directly used for further analysis.<sup>10</sup>

Table 2 presents the overall effect of each of the study outcomes. The mean effect of training on resilience from seven studies is not statistically significant with an estimated effect size of 1.03 ( $p=0.12$ , 95% CI =  $-0.36$  to  $2.41$ ), and there is a substantial amount of heterogeneity with an  $I^2$  estimate of 92.86. The forest plot of the effect of the training interventions on resilience can be found in online supplemental figure S1. Since there were not enough studies to be included in the sensitivity analysis, the estimation excluding quasi-experimental studies was not reported for resilience because of a df lower than 4 in the robust variance estimation models.<sup>36</sup>

The overall effect of the training programmes on depression from nine studies is significant. The pooled effect size is  $-0.47$  ( $p<0.01$ , 95% CI =  $-0.73$  to  $-0.22$ ), indicating an approximately moderate effect favouring treatment. About 58% of variability among the effect sizes for depression was from heterogeneity between studies ( $I^2=57.80$ ). Figure 2 displays the forest plot of the effect of training programmes on depression across these nine studies. The sensitivity analysis including only RCTs shows an effect size of  $-0.42$  ( $p=0.02$ , 95% CI =  $-0.75$  to  $-0.09$ ), which implies the benefit of reducing depression symptoms conferred by the training programmes and that such effect is not impacted by quasi-experimental studies.

The training programme also has a significant overall effect on anxiety, with an approximately moderate effect size favouring treatment (SMD =  $-0.40$ ,  $p=0.03$ , 95% CI =  $-0.73$  to  $-0.06$ ). Nearly 71% of variation was from heterogeneity between these studies ( $I^2=70.59$ ). Figure 3 displays the forest plot for the effect of training programmes on anxiety across the nine studies. This effect, however, became non-significant when excluding the two quasi-experimental studies; the mean effect decreased to  $-0.31$  ( $p=0.12$ , 95% CI =  $-0.73$  to  $0.11$ ).

For perceived stress, the training programmes did not yield a significant overall effect from nine studies with an estimated pooled effect size of  $-1.03$  ( $p=0.07$ , 95% CI =  $-2.15$  to  $0.08$ ), and more than 90% of variability among the effect sizes due to heterogeneity between studies ( $I^2=91.29$ ). The forest plot of the effect of the training programmes on perceived stress can be found in online supplemental figure S2. When quasi-experimental studies were removed, the effect size decreased substantially to  $-0.37$  but became significant ( $p=0.05$ , 95% CI =  $-0.74$  to  $-0.00$ ), indicating a moderate effect of the training programmes on preventing job-related stress. For the four outcomes described, different values of  $r$  specified in the correlated effects meta-regression models did not change the estimation of the pooled effect sizes.



**Figure 1** PRISMA flowchart for search results. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

### Publication bias

Results from the trim-and-fill method show that three studies were missing for depression on the side that is against the treatment effect. With the three imputed studies, the effect decreased slightly but remained significant. For the other outcomes, the results suggest no asymmetry. All funnel plots are available in online supplemental figure S3–6. Overall, the publication bias does not appear to substantially impact the findings.

### Risk of bias assessment

Most studies did not suffer from issues such as baseline differences, contamination and selective outcome reporting. The most common risks of bias included random sequence generation,

allocation concealment and blind outcome assessment. As expected, the highest risk of bias was identified in one quasi-experimental study. Other risks of bias reported in the studies included technical issues of a web application, low usage rates and cancellation of training due to administrative problems.<sup>25 40</sup> The risk of bias rating for each study is available in online supplemental figure S7.

### DISCUSSION

There has been an increasing interest in supporting police officers' mental health in recent years. With a focus on primary prevention, this study synthesised the existing evidence on the effectiveness of psychological skills training programmes on police officers' mental health including resilience, depression, anxiety

**Table 1** Characteristics of studies included in the meta-analysis (n=12)

Study	Country	Training description	Sessions (total training hours)	Methods	Sample size (before attrition)	Follow-up period (months)	Quality summary	Scales of outcomes of interest
Ametz <i>et al</i> (2009) <sup>8</sup>	Sweden	Psychoeducation including relaxation training, use of guided imagery to facilitate imaginal stressful incidents and mental practices	10 (20)	Simple randomised experiment	18 TG=9 CG=9	12	Fair	VAS
Brouzos <i>et al</i> (2022) <sup>8</sup>	Greece	Positive psychology and CBT approach including management of negative thoughts and relaxation techniques, coping strategies and mindfulness-based problem solving, role of meaning, positive mindset and strengths and empathy	6 (6)	Quasi-experimental design	94 TG=49 CG=45	1st: 1 2nd: 1.5	Fair	CD-RISC-10, DASS-21, GAD-7, PHQ-9
Chitra and Karunanidhi (2021) <sup>9</sup>	India	CBT approach, mindfulness and relaxation techniques	20 (30)	Simple randomised experiment	63 TG=33 CG=30	2	Good	OSI, CD-RISC-25, PGWBI
Christopher <i>et al</i> (2018) <sup>28</sup>	USA	Mindfulness-based resilience training	8 (20)	Block randomised experiment*	61 TG=31 CG=30	3	Fair	CD-RISC-25, PROMIS, PSQ
Fitzhugh <i>et al</i> (2019) <sup>40</sup>	UK	Two online interventions: Headspace (a commercially available mindfulness application) and Mindfit Cop (a bespoke online 8-week mindfulness course for policing)	Online intervention	Simple randomised experiment*	1337 Headspace=446 Mindfit Cop=445 CG=446	6	Fair	BRS
Grupe <i>et al</i> (2021) <sup>10</sup>	USA	Mindfulness-based training	8 (18)	Block randomised experiment*	114 TG=57 CG=57	3	Fair	BRS, PSQ, PSS, PROMIS, PTSD Checklist for DSM-5
Horan (2017) <sup>25</sup>	Australia	ACT-based resilience training including coping skills, recognising and appraising stressors, goal significance and activating coping strategies	3 (5.5)	Cluster randomised experiment*	240 TG=120 CG=120	Post-training only	Fair	ERS, DASS-21, PTSD checklist
McCrafty <i>et al</i> (1999), McCrafty and Atkinson (2012) <sup>23,39</sup>	USA	HeartMath Coherence Advantage Training	3 (12)	Simple randomised experiment*	65 TG=29 CG=36	4	Fair	POQA
Navarrete <i>et al</i> (2022) <sup>27</sup>	Spain	Mindfulness-based training	8 (16)	Quasi-experimental design*	62 TG=21 CG=41	Post-training only	Fair	DASS-21
Romosiou <i>et al</i> (2019) <sup>22</sup>	Greece	CBT approach and positive psychology to address emotional intelligence, empathy and resilience	4 (16)	Quasi-experimental design	50 TG=23 CG=27	3	Fair	CD-RISC-25, PSS
Rosmith (2013) <sup>24</sup>	USA	Stress inoculation training including breathing exercises, relaxation techniques, cognitive restructuring and relapse prevention	4 (6), booster: 1 (.5)	Simple randomised experiment*	24 TG=8 TG with booster=8 CG=8	1.25	Fair	POMS-SF, PSS, PSQ
Trombka <i>et al</i> (2021) <sup>12</sup>	Brazil	Mindfulness-based training	8	Simple randomised experiment*	170 TG=88 CG=82	6	Good	HADS

\*Trials included a waitlist control group.

BRS, Brief Resilience Scale; CD-RISC, Connor-Davidson Resilience Scale; DASS-21, Depression, Anxiety and Stress Scales-21; ERS, Ego-Resiliency Scale; GAD-7, Generalised Anxiety Disorder 7-item Scale; HADS, Hospital Anxiety and Depression Scale; OSI, Occupational Stress Inventory; PGWBI, Psychological General Well-being Index; PHQ-9, Patient Health Questionnaire-9; POMS-SH, Profile of Mood States-Short Form; POQA, Personal and Organisational Quality Assessment; PROMIS, Patient-Reported Outcomes Measurement Information System; PSQ, Police Stress Questionnaire; PSS, Perceived Stress Scale; VAS, Visual Analogue Scale.

and perceived stress. Our findings highlight that training did yield some benefit for police officers. In particular, the training programmes are effective in preventing depression symptoms among police personnel. The effect on anxiety is also significant, but the effect became non-significant after removing quasi-experimental studies. While the pooled effects on resilience and

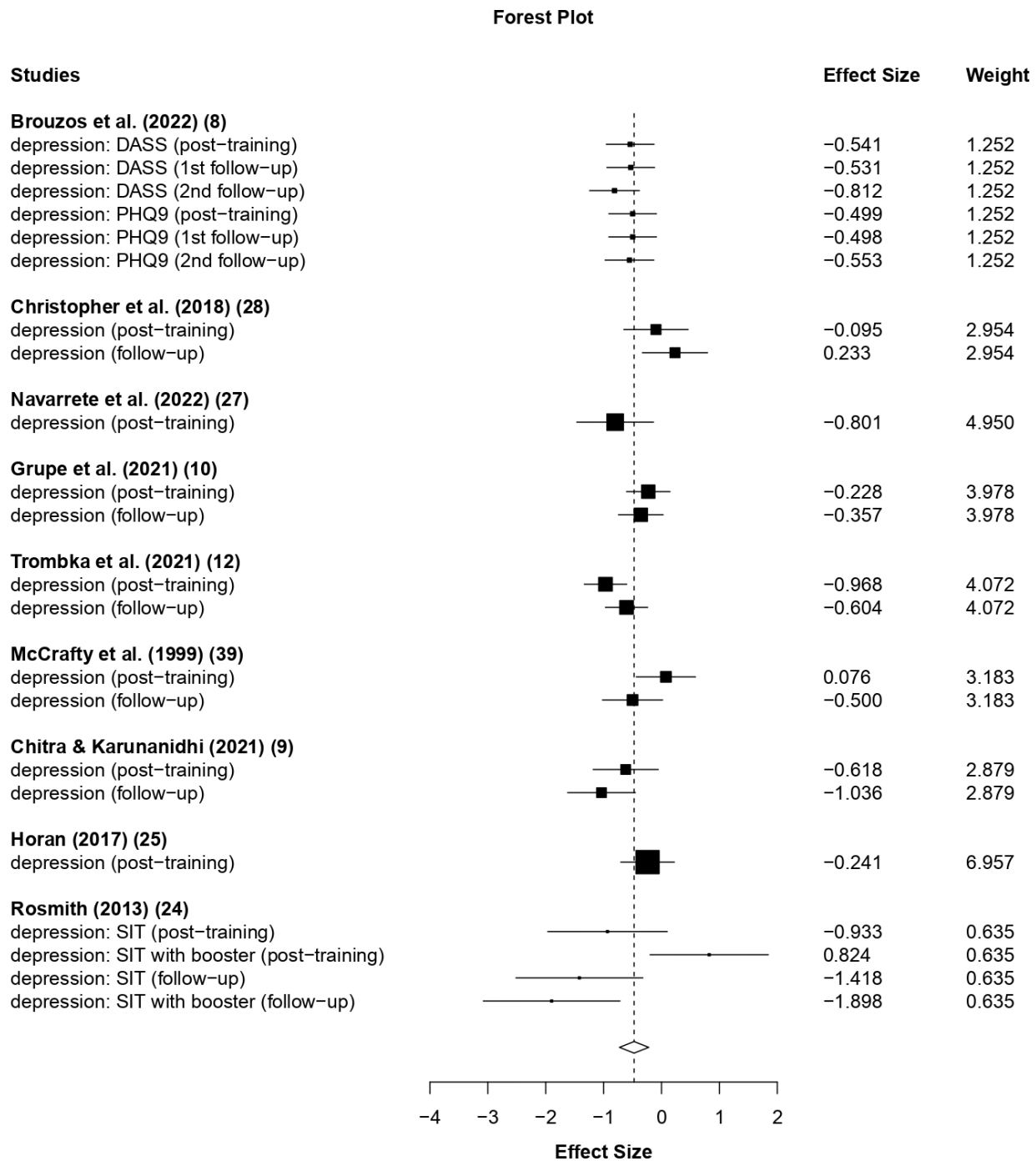
perceived stress are not significant, the expected directions of the effects are encouraging.

The synthesis of nine studies yielded a pooled effect size close to a medium effect for depression ( $-0.47$ ).<sup>41</sup> This effect is robust even after removing quasi-experimental studies from our analysis. Our finding is consistent with a meta-analysis synthesising 18 proactive psychological interventions designed for public safety personnel and front-line healthcare professionals in which significant reductions were observed for depression with an estimated effect size of  $-0.46$ .<sup>42</sup> In terms of anxiety, our study also found an approximately moderate effect ( $-0.40$ ) of the training programmes. This treatment effect aligns with prior meta-analyses of psychological interventions (including training, eye movement desensitisation and reprocessing, critical incident stress debriefing and group counselling) for public safety personnel and healthcare workers including police, firefighters, correctional officers, nurses and emergency medical technicians,

**Table 2** Mean effect sizes and related statistics

Outcome	Effect size	95% CI	t	n	k	$\tau^2$	I <sup>2</sup>
Resilience	1.03	-0.36, 2.41	1.83	7	16	0.58	92.86
Depression	-0.47	-0.73, -0.22	-4.38	9	22	0.09	57.80
Anxiety	-0.40	-0.73, -0.06	-2.75	9	22	0.15	70.59
Perceived stress	-1.03	-2.15, 0.08	-2.14	9	32	0.95	91.29

Effect size=standardised mean difference, t=t-value associated with mean effect size, n=number of studies, k=number of effect sizes,  $\tau^2$ =random effects variance component, I<sup>2</sup>=percentage of variability due to between-study heterogeneity.



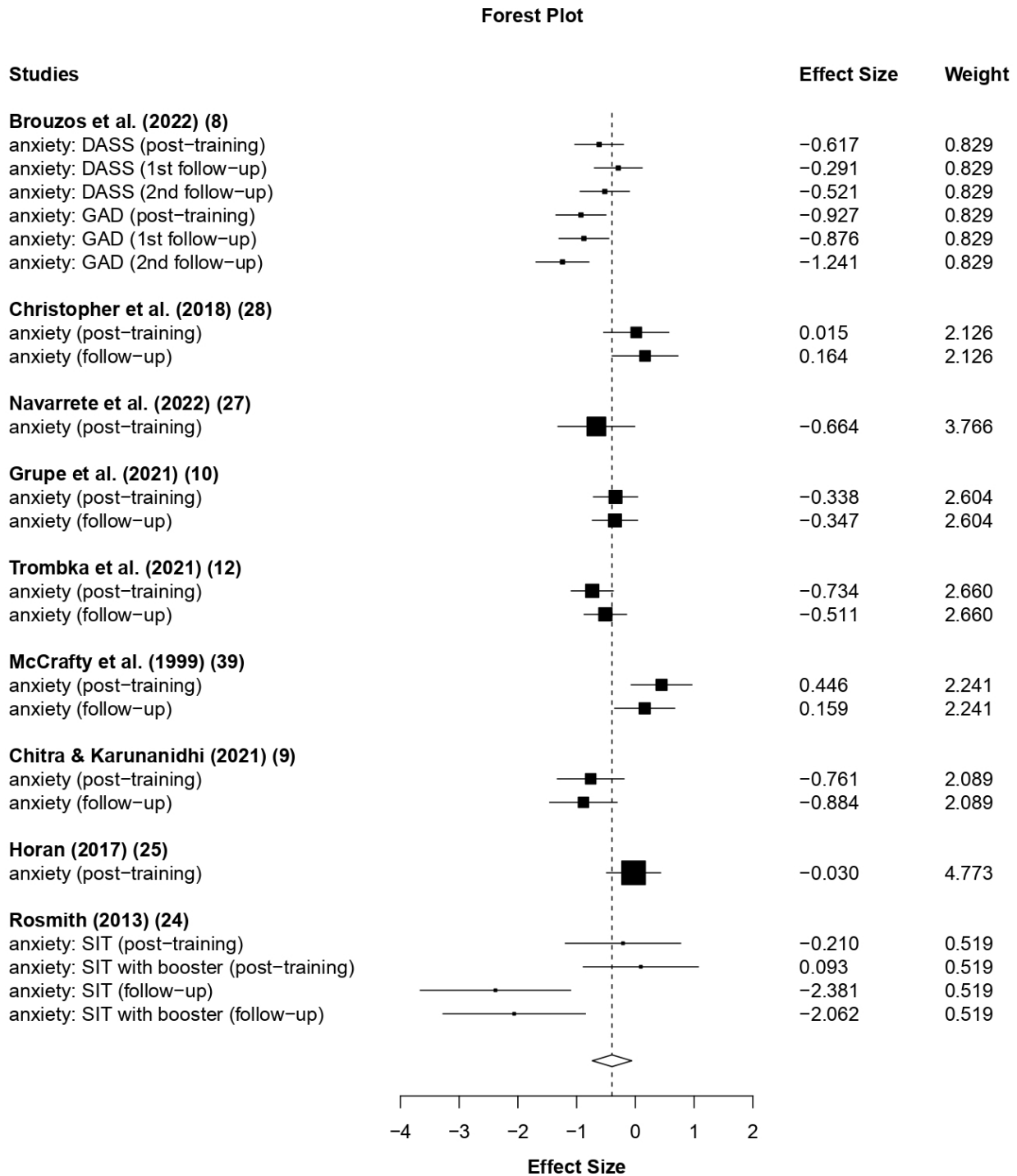
**Figure 2** Forest plot of the effect of training programmes on depression. DASS, Depression, Anxiety and Stress Scales; PHQ-9, Patient Health Questionnaire-9; SIT, stress inoculation training.

which found significant small to medium effects on anxiety.<sup>42 43</sup> However, it should be noted that the effect on anxiety might be confounded by the study design, as it decreased to  $-0.31$  and became non-significant when we removed findings from quasi-experimental studies.

Overall, these findings added to the evidence of the effectiveness of primary prevention by showing that training programmes focusing on resilience, mindfulness and psychoeducation for police officers can potentially mitigate the risk of depression and anxiety. The great variation in the effects might be due to the differences in the nature of training. For example,

the approaches/contents of training, the dosage of interventions, training engagement and home practices or the organisational culture of law enforcement and crime problems in the study sites may impact study outcomes, which warrants future investigation. Additionally, since the follow-up periods of eligible studies were different ranging from one to 12 months, the heterogeneity might have resulted from the duration of follow-ups.

Our study, on the other hand, did not find significant effects of these training programmes on officers' resilience and perceived stress. Though prior reviews have reported the benefit of training programmes in various workplace settings,<sup>33 44</sup> we did not find



**Figure 3** Forest plot of the effect of training programmes on anxiety. DASS, Depression, Anxiety and Stress Scales; GAD, Generalised Anxiety Disorder; SIT, stress inoculation training.

a significant effect of training on enhancing officers’ resilience. The pooled effect size for resilience is relatively large (1.03) but with great variation between studies. The non-significant finding for stress is similar to another meta-analysis in which psychological interventions (including both proactive and reactive approaches) were not associated with a significant reduction in stress for first responders.<sup>43</sup> Despite the fact that no significant effects on resilience and stress were found, the directions of the effects are encouraging. These findings also point out that the existing training programmes can focus more on addressing

these specific needs to provide more comprehensive positive impacts on officers’ mental health.

Our study has important implications for the delivery of these training programmes within law enforcement settings. Depression, anxiety and stress all are common mental health problems among police officers.<sup>3</sup> Given the long-held stigma of mental disorders and the reluctance to seek help in law enforcement,<sup>45 46</sup> primary prevention interventions like training offered for all might be particularly useful as they do not target any high-risk officers—which might increase the

receptivity of the mental health interventions within police organisations. A national survey shows that resilience-building training was one of the least common interventions provided by US police agencies compared with other services like employment assistance programmes, chaplain support or peer counselling/support programmes.<sup>47</sup> With the potential benefit of training identified in this study, police agencies can consider investing more in this primary prevention approach. It might also be worth integrating psychological skills training into police academy education to equip recruits with more adaptive coping skills to enhance their readiness for working in this highly stressful and demanding occupation at the earliest stage of their career.

Moreover, future research can focus more on how to build resilience and alleviate job-related stress through the training programmes designed for police officers. Addressing these mental health needs in the training may yield more benefits. Since there were not enough studies reporting the outcome of PTSD, we were unable to conduct meta-analysis for PTSD. Prior systematic reviews of psychological interventions for first responders have shown promise for reducing PTSD symptoms,<sup>42 43</sup> and an observational study also showed the potential role of specialised training in buffering secondary traumatic stress among police officers.<sup>48</sup> Future intervention studies can also evaluate these stress-related symptoms.

## LIMITATIONS

Though this study provides insightful findings, several limitations should be noted. First, the sample size included in this meta-analysis is small, and therefore, did not allow further moderator analyses. As we did observe great heterogeneity, potential moderators such as study designs, study sites, approaches of training, dosage of training, follow-up periods, whether or not training participation was voluntary based or the makeup of participants in terms of sex or years of service should be examined by future inquiry. Another limitation related to the sample is that one of the nine unavailable studies was very likely eligible for our analysis, but we were unable to obtain the full text of this study.<sup>49</sup>

Second, this meta-analysis focused exclusively on self-reported mental health outcomes that are likely to be under-reported among police officers.<sup>50</sup> Though there is no evidence on the systematic difference in reporting between the treatment and control groups, and most survey data appeared to be collected by research teams rather than police agencies, the tendency to under-report mental health problems among police personnel might have impacted the estimation of the programme's effects. Substantiating the findings on the self-reported outcomes requires further investigation into the differences in psychophysical or biomarker data.

In terms of the threats to internal validity, it should be noted that most studies were rated as high risk or unclear risk under random sequence generation, allocation concealment and blind outcome assessment. Additionally, several studies failed to provide enough information on the dropouts in both treatment and control groups—a common problem in evaluation research on training. Future research should pay more attention to eliminate these risks of bias when implementing and evaluating training programmes in police agencies. A few implementation problems were reported including the technical issues of a web application and the cancellation of a training session,<sup>25 40</sup> which might have lowered the dosage of interventions and made it harder to detect treatment effects. These issues should be a point of focus for implementation fidelity in future evaluations as well.

As most training programme attendees were voluntary, self-selection bias might have created a sample with higher motivation to improve mental health. Thus, the synthesis of the effects from the existing research might not be applicable to less motivated officers. Lastly, due to ethical concerns, two-thirds of the trials included in the analysis involved a waitlist control group. It is likely that the effects might have been overestimated as shown in a meta-analysis of CBT.<sup>51</sup> The waitlist-control design might be more pragmatic for this type of intervention implemented within many of the police agencies. Thus, we believe that these controlled trials still shed light on the field of psychological skills training for police personnel.

## CONCLUSION

Perpetual exposure to critical incidents at work leaves police personnel a population vulnerable to mental health problems. Therefore, it is important to help police officers better prepare for potential stressors inherent in this profession. As there has been an increase in the primary prevention training programmes implemented in law enforcement settings in recent years, this study synthesised the existing evidence on psychological skills training for police personnel. Our meta-analysis shows that the training programmes can potentially mitigate the risk of depression and anxiety. This research contributes to the knowledge of the effectiveness of psychological skills training for police officers and highlights the importance of primary prevention in supporting officers' mental health.

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**Ethics approval** This study analysed and synthesised anonymised data from previous clinical trials in which informed consent has already been obtained. This research did not recruit human subjects and did not require human subjects review.

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## Supplementary Materials

**Table S1.** Search Strategy

Databases	Selected databases	Search date	Other parameters	Keywords	Search hits
ProQuest	Australia & New Zealand Database Continental Europe Database Criminal Justice Database East & South Asia Database East Europe, Central Europe Database Policy File Index ProQuest Dissertations & Theses Global Psychology Database PTSDpubs Public Health Database Publicly Available Content Database UK & Ireland Database	2/3/2023	Source types included books, conference paper & proceedings, dissertations & theses, government & official publications, reports, scholarly journals.	In title or abstract: 1. (police OR policing OR officer* OR law enforcement) AND 2. (resilien* OR mindful* OR psychological OR mental OR toughness) AND 3. (training OR education* OR intervent* OR program*) AND In full text/all fields: 4. (experiment* OR quasi* OR evaluat* OR control* OR comparison* OR random* OR nonrandom* OR non-random OR RCT OR effect* OR impact* OR intervent*)	3,427
EBSCO	Academic Search Complete Alt HealthWatch APA Psych Articles APA Psych Books APA Psych Extra APA Psych Info	1/29/2023	Source types excluded magazines, trade publications, and news.		7,485

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	Criminal Justice		
	Abstracts		
	Global Health		
	Health Source-		
	Nursing/Academic		
	Edition		
	MEDLINE		
	Mental Measurements		
	Yearsbook with Tests in		
	Print		
	National Criminal Justice		
	Reference Service		
	Abstracts		
	Psychology and		
	Behavioral Sciences		
	Collection		
	Public Administration		
	Abstracts		
	Social Work Abstracts		
	SocINDEX		
	Violence & Abuse		
	Abstract		
Web of	Social Sciences Citation	2/3/2023	1,586
Science	Index		
	Conference Proceedings		
	Citation Index – Social		
	Sciences and Humanities		
	Book Citation Index –		
	Social Sciences and		
	Humanities		

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**Table S2. Review studies used for handsearching**

Review studies	Eligible studies identified from the references
<p>1. Alshahrani KM, Johnson J, Prudenzi A, O'Connor DB. The effectiveness of psychological interventions for reducing PTSD and psychological distress in first responders: A systematic review and meta-analysis. <i>PLOS ONE</i>. 2022;17(8):e0272732. doi:<a href="https://doi.org/10.1371/journal.pone.0272732">10.1371/journal.pone.0272732</a></p>	<p>Fitzhugh H, Michaelides G, Connolly S, Daniels K. <i>Mindfulness in Policing: A Randomized Controlled Trial of Two Online Mindfulness Resources across Five Forces in England and Wales</i>. College of Policing; 2019.</p>
<p>2. Brassington K, Lomas T. Can resilience training improve well-being for people in high-risk occupations? A systematic review through a multidimensional lens. <i>The Journal of Positive Psychology</i>. 2021;16(5):573-592. doi:<a href="https://doi.org/10.1080/17439760.2020.1752783">10.1080/17439760.2020.1752783</a></p>	
<p>3. Claringbold G, Robinson N, Anglim J, Kavadas V, Walker A, Forsyth L. A systematic review of well-being interventions and initiatives for Australian and New Zealand emergency service workers. <i>Australian Journal of Psychology</i>. 2022;74(1):2123282. doi:<a href="https://doi.org/10.1080/00049530.2022.2123282">10.1080/00049530.2022.2123282</a></p>	
<p>4. Corthésy-Blondin L, Genest C, Dargis L, Bardon C, Mishara BL. Reducing the impacts of exposure to potentially traumatic events on the mental health of public safety personnel: A rapid systematic scoping review. <i>Psychological Services</i>. 2022;19(Suppl 2):80-94. doi:<a href="https://doi.org/10.1037/ser0000572">10.1037/ser0000572</a></p>	
<p>5. Corthésy-Blondin L, Genest C, Dargis L, Bardon C, Mishara BL. Reducing the impacts of exposure to potentially traumatic events on the mental health of public safety personnel: A rapid systematic scoping review. <i>Psychological Services</i>. 2022;19(Suppl 2):80-94. doi:<a href="https://doi.org/10.1037/ser0000572">10.1037/ser0000572</a></p>	
<p>6. Edgelow M, Scholefield E, McPherson M, Mehta S, Ortlieb A. A review of workplace mental health interventions and their implementation in public safety organizations. <i>Int Arch Occup Environ Health</i>. 2022;95(3):645-664. doi:<a href="https://doi.org/10.1007/s00420-021-01772-1">10.1007/s00420-021-01772-1</a></p>	

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  8. Maglione MA, Chen C, Bialas A, et al. Combat and Operational Stress Control Interventions and PTSD: A Systematic Review and Meta-Analysis. *Military Medicine*. 2022;187(7-8):e846-e855. doi:[10.1093/milmed/usab310](https://doi.org/10.1093/milmed/usab310)
  9. Robertson IT, Cooper CL, Sarkar M, Curran T. Resilience training in the workplace from 2003 to 2014: A systematic review. *Journal of Occupational and Organizational Psychology*. 2015;88(3):533-562. doi:[10.1111/joop.12120](https://doi.org/10.1111/joop.12120)
  10. Tan L, Petrie K, Deady M, Bryant RA, Harvey SB. Systematic review of first responder post-deployment or post-incident psychosocial interventions. *Occupational Medicine*. 2022;72(3):160-169. doi:[10.1093/occmed/kqab182](https://doi.org/10.1093/occmed/kqab182)
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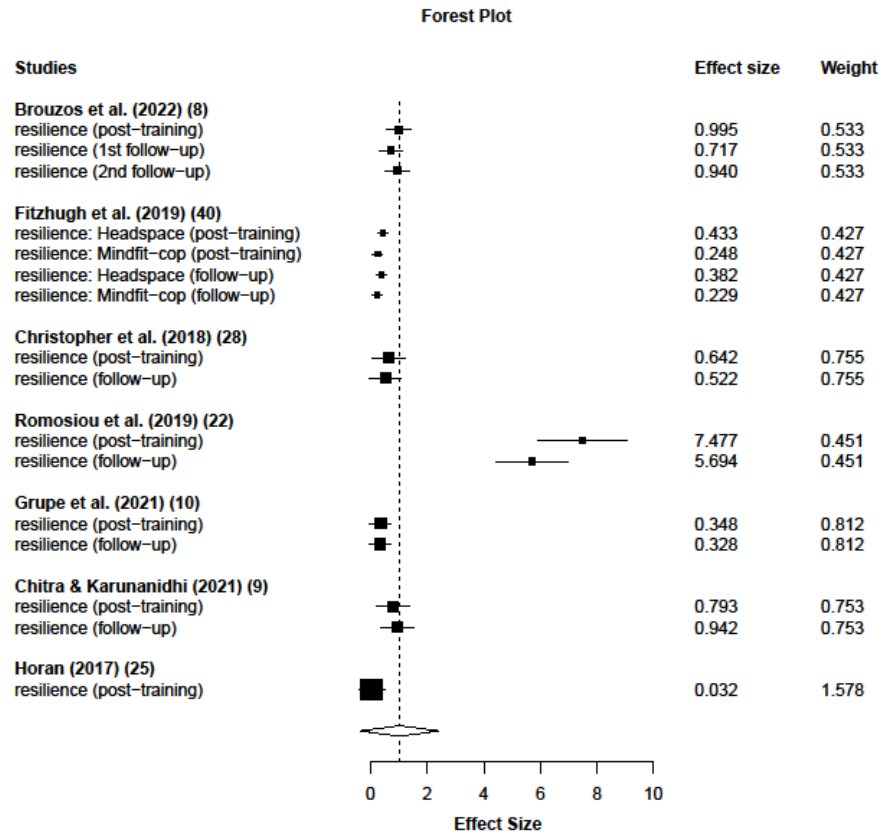
### Supplementary Material 3: Effect sizes calculation adjustment for quasi-experimental studies

$$d = \frac{\bar{X}_{txt-post} - \bar{X}_{ctl-post} - (\bar{X}_{txt-pre} - \bar{X}_{ctl-pre})}{\sqrt{((n_{txt}-1) s_{txt-post}^2 + (n_{ctl}-1) s_{ctl-post}^2) / (n_{txt} + n_{ctl} - 2)}}$$

in which  $\bar{X}_{txt-post}$  is the mean score for the treatment group at post-training or follow-up,  $\bar{X}_{ctl-post}$  is the mean score for the control group at post-training or follow-up,  $\bar{X}_{txt-pre}$  is the mean score for the treatment group at baseline,  $\bar{X}_{ctl-pre}$  is the mean score for the control group at baseline,  $s_{txt-post}$  is the standard deviation of post-training score for the treatment group,  $s_{ctl-post}$  is the standard deviation of post-training score for the control group,  $n_{txt}$  is the sample size of the treatment group, and  $n_{ctl}$  is the sample size of the control group. If two groups are similar in any given outcome at baseline (i.e.,  $\bar{X}_{txt-pre} - \bar{X}_{ctl-pre} \cong 0$ ), then the effect size will be approximate to SMDs calculated for RCTs.

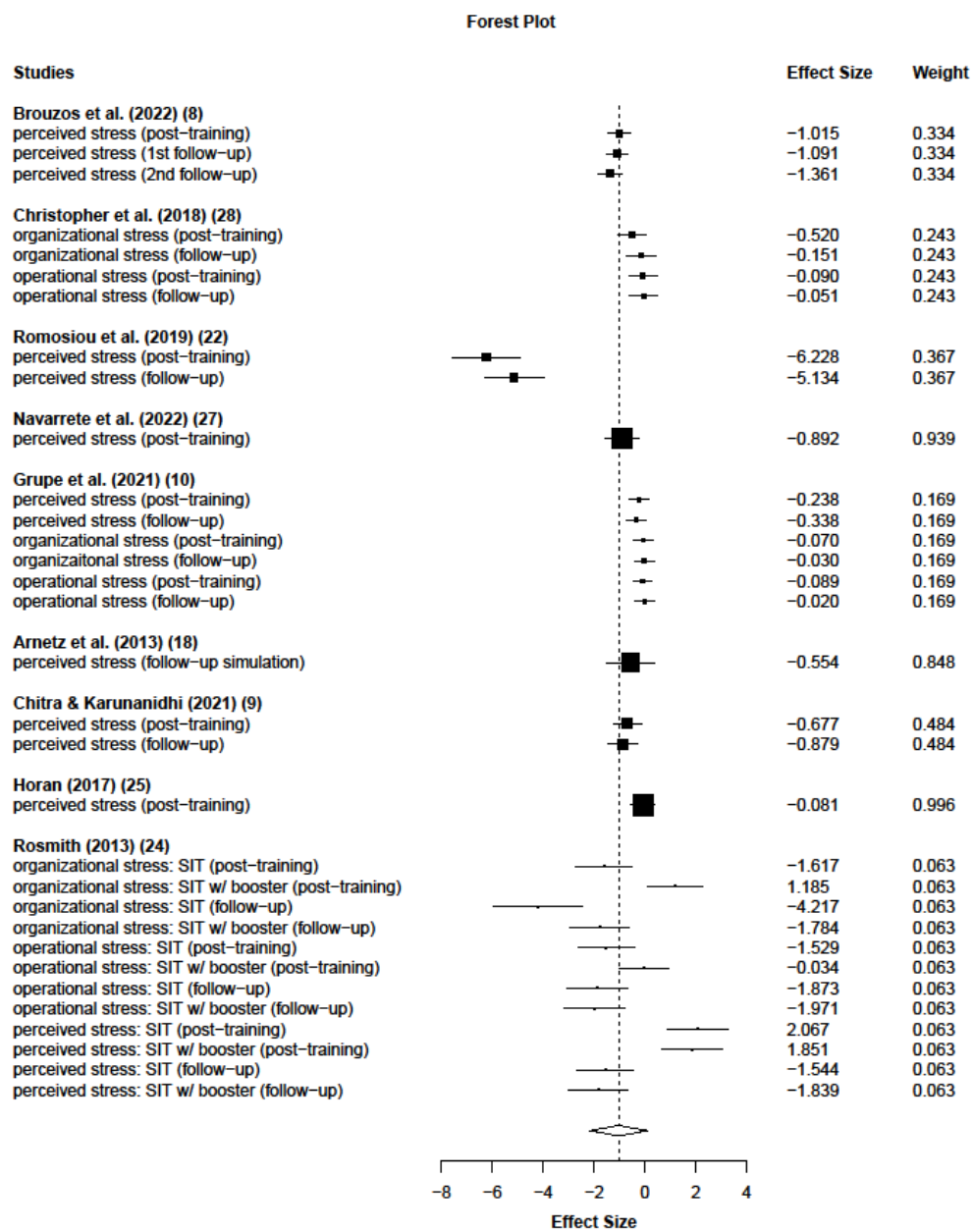
**Table S4.** Quality assessment scores

<b>Study</b>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	total		
Fitzhugh et al. (2019)	1	1	1	1	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	16	
Arnetz et al (2009)	1	1	0	1	0	1	1	0	1	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1	0	17	
Chitra and Karunanidhi (2021)	1	1	1	1	2	1	1	0	1	1	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	22	
Christopher et al. (2018)	1	1	1	1	2	1	1	0	0	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	19	
Grupe et al. (2021)	1	1	1	1	2	0	0	0	1	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	18	
Horan (2017a)	1	1	0	1	2	1	1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	17	
McCrafty et al. (1999)	1	1	0	1	1	1	1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	16	
Rosmith(2013)	1	1	0	1	0	1	1	0	1	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1	0	17	
Trombka et al (2021)	1	1	1	1	2	1	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	21
Brouzos et al. (2022)	1	1	0	1	2	1	1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	0	0	0	1	0	17	
Romosiou et al. (2019)	1	1	0	1	2	1	1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	0	0	0	0	1	0	16	
Navarrete et al. (2022)	1	1	1	1	2	1	1	0	0	1	0	0	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	17	
Meulen et al. (2019)	1	1	0	1	2	1	1	0	1	1	0	0	1	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	14	
Au et al. (2018)	1	1	0	1	0	1	1	0	1	0	0	0	1	0	0	1	0	1	1	1	1	1	1	0	0	0	1	0	14	
Horan (2017b)	1	1	0	1	2	1	1	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	14	

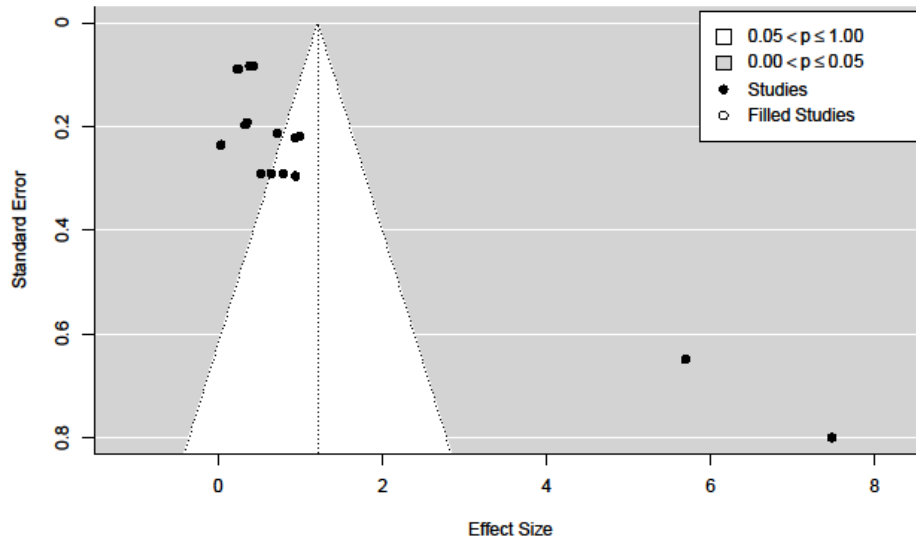


**Figure S1.** Forest plot of the effect of training programs on resilience

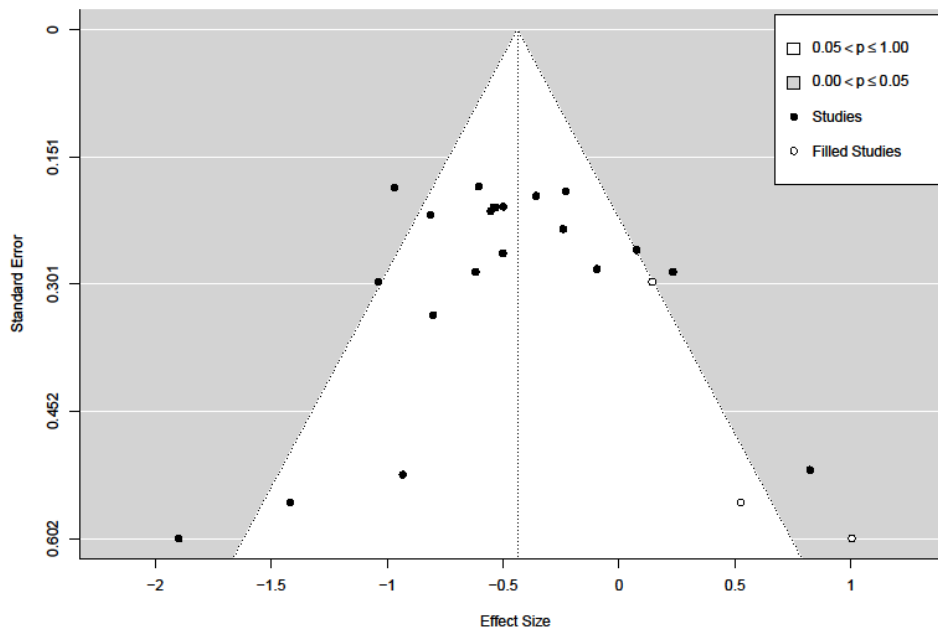




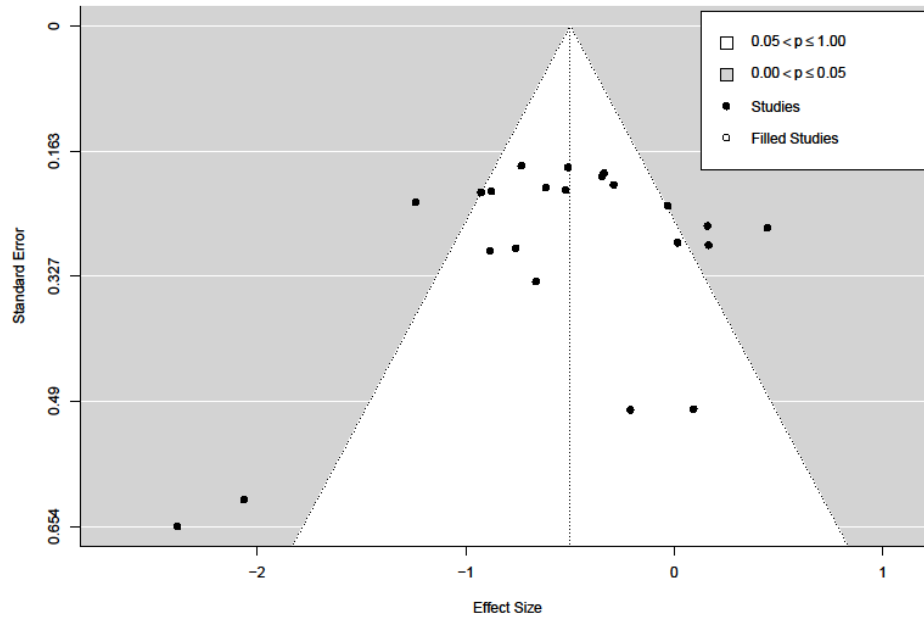
**Figure S2.** Forest plot of the effect of training programs on perceived stress



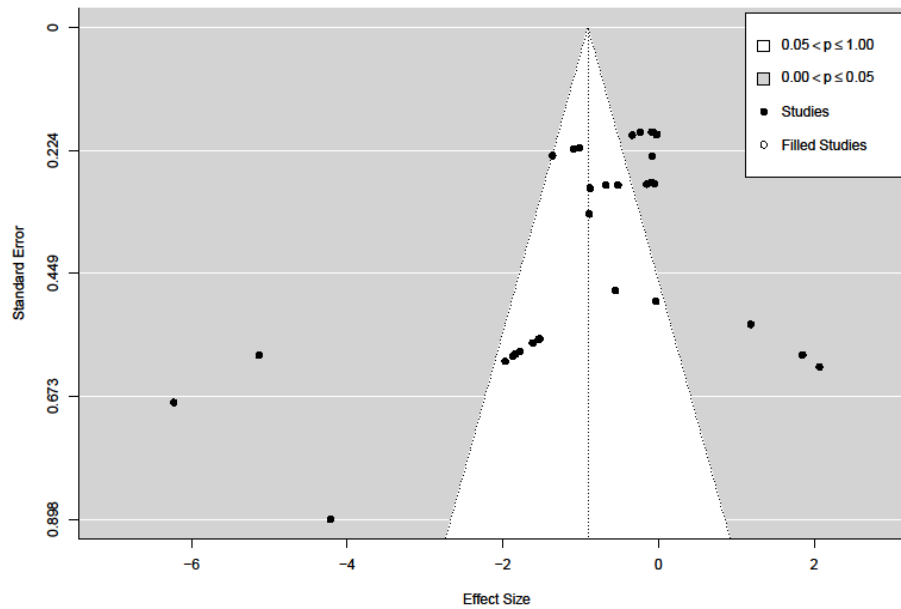
**Figure S3.** Funnel Plot of resilience



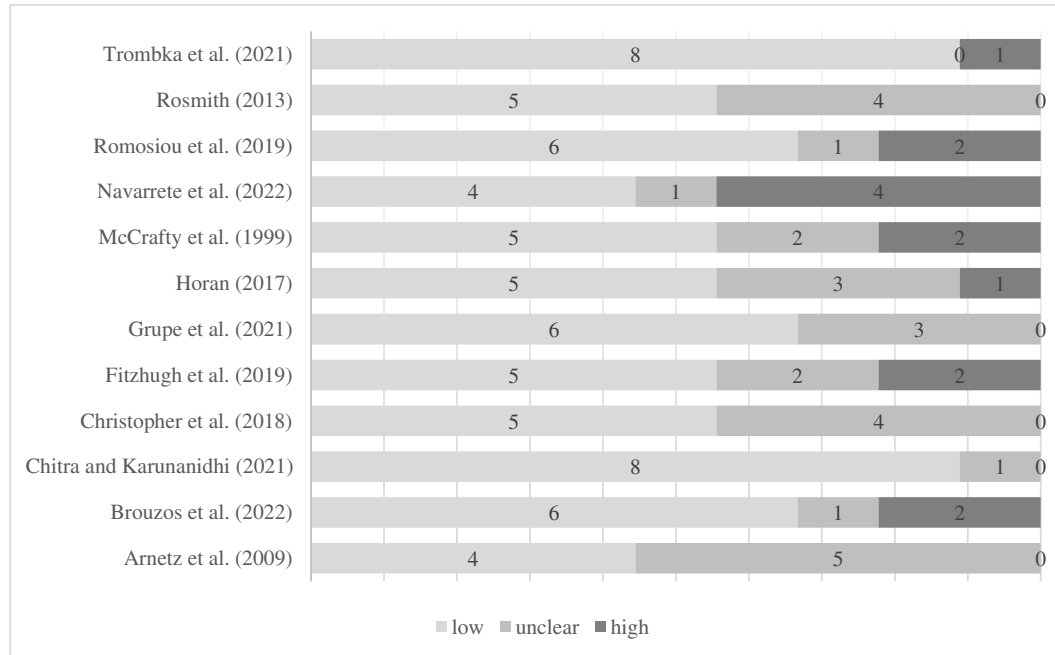
**Figure S4.** Funnel Plot of depression



**Figure S5.** Funnel Plot of anxiety



**Figure S6.** Funnel Plot of perceived stress



**Figure S7.** Rating of studies included in the meta-analysis on the 9 EPOC risk of bias criteria