Global prevalence and risk factors for mental health problems in police personnel: A systematic review and meta-analysis

Authors
Shabeer Syed, MSc[1,2*]
shabeer.syed@hmc.ox.ac.uk
+44 (0) 7999221230

Rachel Ashwick, MSc[1]
rachel.ashwick@hmc.ox.ac.uk

Marco Schlosser, MSc[2]
marco.schlosser@ucl.ac.uk

Rebecca Jones, PhD[2]
reb.jones@ucl.ac.uk

Sarah Rowe, PhD[2]
sarah.rowe@ucl.ac.uk

Jo Billings, DClinPsy[2]
j.billings@ucl.ac.uk

Affiliations:
[1] Oxford Institute of Clinical Psychology Training, University of Oxford, Medical Sciences Division, Warneford Hospital, Headington, Oxford, OX3 7JX, UK. *Corresponding author.

[2] Division of Psychiatry, University College London, 6th Floor, Maple House, 149 Tottenham Court Road, London, W1T 7NF, UK.

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Abstract

Objectives: Police face an increased risk for developing mental health problems, yet reliable estimates of their psychological difficulties remain unknown. This systematic review and meta-analysis estimate the pooled prevalence and risk factors for mental health problems among police personnel worldwide.

Methods: Three independent reviewers searched 16 databases and screened 11,506 articles published between Jan 1980 and Oct 2019. Eligible studies involved at least 100 active police professionals and used validated instruments to ascertain specific mental health problems. Estimates were pooled using random-effects meta-analyses.

Results: In total, 60 cross-sectional and 7 longitudinal studies, involving 272,463 police personnel from 24 countries met criteria for inclusion. The overall pooled point prevalence was 14.6% for depression (95% CI 10.9%-18.6%), 14.2% for posttraumatic stress disorder (PTSD; 95% CI 10.3%-18.7%), 9.6% for a generalised anxiety disorder (95% CI 6.7%-12.9%), 8.5% for suicidal ideation (95% CI 6.1%-11.2%), 5.0% for alcohol dependence (95% CI 3.5%-6.7%), and 25.7% for hazardous drinking (95% CI 19.6%-32.4%). The strongest risk factor for depression and suicidal ideation was higher occupational stress, and the strongest risk factors for PTSD were higher occupational stress and avoidant coping strategies. Higher levels of co-worker support were associated with significantly lower PTSD symptoms.

Conclusions: Our findings suggest that the prevalence of mental health problems among police exceed twice that previously reported in mixed samples of first responders, and is associated with

poor social support, occupational stress and maladaptive coping strategies. Without effective intervention, psychological difficulties will remain a substantial health concern among police.

Box. key messages

What is already known about this subject?

- Studies suggest that the prevalence of mental health problems among first responders are higher than the general population.
- Most studies on police personnel report elevated levels of post-traumatic stress disorder (PTSD), yet comprehensive estimates for wider mental health problems among police are lacking.

What are the new findings?

- Results suggest that around 1 in 5 of police officers screened positive for hazardous drinking, 1 in 7 met criteria for PTSD and depression, and 1 in 10 met criteria for an anxiety disorder or suicidal ideation.
- Findings indicate that poor social support, higher occupational stress and individuals' maladaptive coping strategies are strong risk factors for potential mental health problems among police.

How might this impact on policy or clinical practice in the foreseeable future

- Police officers show a substantial burden of mental health problems, emphasising the need for effective interventions and monitoring programs.
- The results support increased funding initiatives for police wellbeing to match preventative efforts currently offered in other high-risk populations.

Introduction

Police personnel in the UK and U.S respond to an estimated 10 to 35 million calls annually,[1,2] ranging from mental health crises and violent assaults to the deaths of fellow officers.[3] Repeated traumatic exposure in police is associated with an increased risk of developing mental health problems, and represents a substantial public health concern.[4-6] The prevalence of police PTSD and depression are reported to exceed twice that of the general population (20% vs. 7–9%),[7, 8] and are linked to poorer quality of life,[9] elevated risk of errors, [10] aggression,[10] cardiac deaths,[11] substance misuse,[12] absenteeism,[13, 14] and suicide.[15]

Despite these health risks, reliable estimates on the prevalence and risk factors for psychological difficulties among police remain unknown. Epidemiological estimates range from 0.8% to 41.1% for PTSD,[16, 17] and from 5% to 43% for alcohol misuse.[18, 19] Commonly reported risk factors for mental disorders, including prior childhood trauma, being female, younger age, and emotional responses, often fail to produce consistent results.[20] Instead, most cited estimates rely on indirect data derived from mixed samples of multidisciplinary disaster workers, with little relevance to police. Approximately 600 studies relevant to psychiatric problems among rescue workers have been identified in recent meta-analyses,[21-27] with only six independent police samples on PTSD.[28-33] Compared to other first responders, police are uniquely exposed to graver interpersonal violence (e.g. homicide),[28] and negative perceptions by the public and their peers.[29] Police-specific studies are, however, limited by small, cross-sectional and non-representative convenience samples of 43 to 300 participants.[21] The few existing epidemiological police studies are based on the same sample or department,[30] leading to selection bias and limited generalisability across police organisations.

Reliable epidemiological insights into the mental health of police are urgently needed to inform policy and intervention for at-risk personnel. This meta-analysis provides the first comprehensive summary of studies published on the prevalence and risk factors for mental health problems among police worldwide.

Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses and the Meta-analysis of Observational Studies in Epidemiology guidelines.[36, 37] The review protocol was published in the PROSPERO registry before full commencement (CRD42018111847).[31]

Search strategy and study eligibility

We searched MEDLINE®, PsycINFO, EMBASE, Web of Science, AMED, CINAHL, PILOTS, SciVerse Scopus, the Cochrane Library, PubMed, ERIC, Global Health Archives, ProQuest Central, OpenGrey and Google Scholar for English, Swedish or German language articles published between 1 January, 1980 and 8 October, 2019. We used a comprehensive list of search terms developed in consultation with a librarian. Due to their high publication rate of police-related studies, the *Journal of Psychiatric Research*, *Journal of Policing*, *Journal of Traumatic Stress* and *Journal of Nervous Mental Diseases* were hand-searched along with reference lists of relevant full-text articles and reviews.[21-27] Finally, 16 frequently cited police health authors were contacted for additional article recommendations. The last retrieval of studies occurred on October 20, 2019. The complete search strategy is described in supplementary table S1.

Three independent researchers (S.S, R.A and M.S) reviewed abstracts, full-text articles and corresponding reference lists using Covidence's systematic review software.[32] Any disagreement over study inclusions between reviewers was resolved by a fourth independent reviewer (J.B).

We included studies if they (1) reported on police-specific data to calculate the point prevalence of a specific mental health problem or its associated risk, (2) used a validated instrument or qualified clinician interview to ascertain psychiatric symptoms, (3) involved a sample size ≥100 participants, (4) were rated as low risk of bias as per the Newcastle-Ottawa Scale (NOS; score: ≥3), (5) reported on the same outcome/risk factor as three other eligible studies, (6) were published in English, Swedish or German, and (7) comprised a peer-reviewed publication or a nationally representative report. We classified alcohol misuse into two categories of severity: high-risk or hazardous drinking (moderate), and harmful drinking or alcohol dependence (severe), aligning with national guidelines and instrument cut-off scores.[33, 34] Given the volume of available studies, we excluded studies rated as low in methodological quality to condense between-study heterogeneity and to increase the validity of pooled estimates.

When studies were based on the same sample, we extracted data from all studies and prioritised the highest NOS quality-rated study and then the study with the largest sample size per outcome, minimising bias from non-independent samples.[33] Finally, to isolate studies to exposures related to police work and to provide comparable estimates to the overall police population, we excluded case studies, retired personnel, trainees, clinical populations and studies based on electronic health registries.

Data extraction and quality assessments

Using a standardised data extraction form, the three reviewers independently extracted: sample characteristics (e.g. sample size, age (mean/range, years), percentage of males); response rate; follow-up time; psychiatric measure and cut-off score; effect sizes (e.g. prevalence, odd ratios, Pearson's r etc.); and main type of trauma exposure (event endorsed by >70% of the

sample). We requested additional data from 30 authors, 17 of whom replied within the two-month deadline (57% response rate). The remaining 13 studies were excluded, as no relevant estimates could be ascertained.

The methodological quality and risk of bias of each study were assessed by the three reviewers using a modified version of the Newcastle-Ottawa Scale (NOS).[43, 44] The NOS assesses three methodological domains: selection (maximum two points, including representativeness of the sample and sample size), comparability (maximum one point, including comparing non-responders with responders), and outcome (maximum two points, including outcome assessment and quality of reported statistics) with a maximum score of five (table S2). Consistent with previous meta-analyses,[34] studies were classified as high risk of bias/low quality (score: <3) or low risk/moderate to high quality (score: ≥3).

Data analyses

We pooled prevalence estimates of each outcome using random-effects meta-analyses as per the pre-specified protocol,[31] accounting for the observed between-study heterogeneity.[35] We also applied the Freeman–Tukey double arcsine transformation to stabilize the variance of each estimate,[36] as several estimates were close to zero. The point prevalence was defined as the number of identified cases (per instrument cut-off score) divided by the total number of participants assessed at that same time. If longitudinal studies reported estimates for multiple periods, we used the overall period prevalence.

We pooled correlation estimates on risk-factors using random or fixed effects meta-analyses (I^2 <50%), based on the inverse-variance method. The inverse-variance method allowed larger studies with smaller standard errors to carry more weight.[37] We also applied the Hartung

and Knapp method to ensure greater precision when pooling risk factors with a smaller number of studies (k<4) and high between-study heterogeneity (I^2> 50%).[38] Extracted correlation effect estimates were converted to the log odds ratio,[39] providing an approximate estimate of the odds ratio. Any multiple effect estimate presented for the same overall risk factor was averaged and weighted for degrees of freedom. Log odds ratios were back-transformed into odds ratios for the convenience of interpretation.

Between-study heterogeneity of estimates was assessed using the I^2 statistic (>75%=illustrates substantial heterogeneity), standard X^2 tests and prediction intervals.[40, 41] To further investigate between-study heterogeneity, estimates were stratified by pre-specified subgroups,[31] defined as potential sources of variation when at least four studies were available for each comparator group. The influence of age, sex and year of publication were examined using random-effects meta-regressions. The impact of individual study estimates on the between-study heterogeneity was explored by serially omitting individual studies from the overall estimate. Finally, publication bias was examined using Egger's test, Begg and Mazumdar's rank test, and visually through funnel plots when at least ten studies were present.[40,41] R version 3.6.1 (R Foundation for Statistical Computing) and "meta" package was used to perform all analyses.[42,43]

Results

Study characteristics

Individual key study characteristics are summarised in supplementary table S3. In total, 60 cross-sectional and 7 longitudinal studies (75 sources),[4, 5, 12, 18, 19, 44-114] involving 272,463 police personnel from 24 countries met criteria for inclusion (figure 1). Of these, 44 different studies provided estimates on PTSD, 27 studies on depression, 12 studies on alcohol misuse, 11 studies

on an anxiety disorder, 10 studies on suicidal ideation, and 3 studies on drug misuse. Most studies were from North America (31 studies, 46%), followed by Europe (19 studies, 28%) and Australia (7 studies, 10%), with a median sample size of 631 (range: 100-100,518). The population were primarily male (median percentage: 76%), working within general police duty areas (82%, 55 studies), with a median age of 39.1 years (range: 19-77 years). The majority of studies used self-report questionnaires (61 studies, 91%), whereas 6 studies used a Structured Clinical Interview (9%) to ascertain psychiatric symptoms.[115-117]

Quality assessment

The overall quality of 30 studies was high (46%; NOS score >3) and 37 studies were of moderate quality (54%; NOS score=3). Four studies were large nationally representative surveys comprising between 3,272 and 8,581 police personnel from Poland,[48] Norway,[50] Australia,[118] Canada,[18] respectively. Individual study methodological quality NOS scores are depicted in supplementary table S4.

Prevalence of mental health problems

The pooled prevalence estimates were 14.2% for PTSD or PTSD symptoms (95% CI 10.3%-18.7%, k=29), 14.6% for depression or depressive symptoms (95% CI 10.6-18.6%, k=22), 25.7% for hazardous or high-risk drinking (95% CI 19.6%-32.4%, k=9), 9.6% for a generalized anxiety disorder (95% CI 7.7%-14.6%, k=10), 8.5% for suicidal ideation (95% CI, 6.1%-11.2%, k=10), and 5.0% for harmful drinking or alcohol dependence (95% CI 3.5%-6.7%, k=7). All estimates showed significant between-study heterogeneity (range Q=138.5-3397.2; range I^2=95.7%-99.2%; range τ^2= 0.00-0.026; all p<0.001) but demonstrated moderate variation in terms of predictions intervals (figures 2-4). Three studies also reported on estimates for random drug tests in police (e.g.

cocaine, marijuana and anabolic steroids).[45, 89, 99] However, the small number of studies and the substantial between-study heterogeneity (prediction interval: 0% to 100%) precluded any reliable meta-analytic pooling (pooled estimates shown in figure S2).

Sensitivity analysis of prevalence estimates

Serially omitting each study in separate sensitivity analyses highlighted that no study impacted on the overall prevalence of PTSD, depression, suicidal ideations and alcohol dependence by more than 0.5%. For hazardous drinking and anxiety disorders, exclusion of two studies,[19, 87] and one study,[68] respectively, affected the overall prevalence by more than 1%. No study exclusion markedly affected the between-study heterogeneity (range I^2=97.7%-98.5%; p<0.01).

Subgroup analyses of prevalence estimates

Details of each subgroup analysis are provided in supplementary tables S5 to S6. Overall, we found significantly higher estimates of PTSD in studies from Asia, South America or Africa (21.2%) relative to other continents (range: 7.8%-16.5%); and in studies with police personnel indirectly exposed to dead bodies or severe injuries (24.2%), compared to directly life-threatening events or disasters (prevalence range: 6.9%-16.7%) (test for subgroup differences, all p<0.05).

For depression, we found significantly higher prevalence estimates in studies from Asia, Africa or Australia reported (24.9%) than studies from Europe (10.6%) or North America (15.0%); in studies with smaller sample sizes (<200 participants) showed higher estimates (17.0%) than larger studies (8.5%); and in studies with lower NOS quality score on the comparability between respondents and non-respondents (17.3%) than studies with higher NOS score (9.5%). Together, the results suggest that differences in study continent and type of trauma exposure explained

some of the between-study heterogeneity observed in PTSD and depression, whereas fewer factors helped explain the variation across other psychiatric conditions.

Meta-regressions of prevalence estimates

In separate meta-regressions, no prevalence estimate was significantly affected by publication year, mean age or studies proportion of males (p>0.05 for all between-group comparisons; tables S5-S6).

Publication bias of prevalence estimates

We found little or no evidence for asymmetry following visual inspections of funnel plots (supplementary figures S3-S8), and there was no evidence for small-study effects (Egger's test range= -0.5 to 4.5, Rank's test range=-23.0 to 9.0, p-values range=0.51-0.79).

Risk factors for mental health problems

Figure 4 presents the odds ratios for each pooled risk factor by type of mental health problem, as reported at least three times by 49 different studies. Individual study estimates for each risk factor are presented in figures S7-S10.

Risk factors for PTSD

Pooled data from 30 studies revealed that police PTSD was significantly associated with being female (OR 1.56, 95% CI 1.11-2.18, k=8), greater trauma frequency (OR 2.03, 95% CI 1.41-2.92, k=9), longer time in policing (OR 1.41 95% CI 1.01-1.95, k=6), avoidant coping strategies (OR 3.91, 95% CI 1.19-12.84, k=6), higher levels of alcohol consumption (OR 2.44, 95% CI 1.34-4.42, k=4), and higher occupational stress (OR 3.50, 95% CI 2.60-4.72, k=8) (all p<0.05; figure 4). By contrast, higher levels of peer-support (OR 0.65, 95% CI, 0.43-0.99, k=4) was associated with

significantly lower PTSD symptoms. There was moderate to substantial between-study heterogeneity across all pooled risk factors (range I^2=46.7%-98.5%; figure 5).

Risk factors for depression, suicidal ideation and hazardous drinking

Of the 15 studies reporting on depression (figure 5), being female was significantly associated with depressive symptoms (OR 2.09, 95% CI 1.93-2.26, k=3), and higher levels of generic occupational stress were significantly associated with both depression (OR 3.74, 95% CI 2.70-5.18, k=8) and suicidal ideation (OR 1.72, 95% CI 1.52-1.93, k=4). For alcohol misuse, being male was significantly associated with hazardous drinking (OR 1.49, 95% CI 1.29-1.71, k=5). The between-study heterogeneity ranged from low to high across all outcomes (range I^2=0.0%-95.3%).

Meta-regressions of risk factors

Meta-regressions revealed that studies with a higher percentage of males were associated with an increased effect of co-worker support on PTSD symptoms (estimate: -0.15, 95% CI -0.23 to -0.08, *p*=0.012; table S7).

Sensitivity analysis of risk factors

Serially omitting individual studies from risk factors with at least five studies illustrated that the strength of the association and the between-study heterogeneity between PTSD, time in policing and avoidant coping varied substantially depending on the study (*p*-value range: 0.00-0.12; I^2 *range*=53.5%-98.9%). All other estimates remained generally constant.

Publication bias of risk factors

Publication bias was discerned in studies reporting on the association between age and PTSD (Egger's test: bias =-6.35, p=0.752; Rank test=23.0, p=0.04). No evidence for publication bias was observed across all other conditions (Egger's test and Rank's test p>0.2; see figure S13 for funnel plots).

Discussion

Based on data from 272,463 police personnel and 24 countries, we found that about 1 in 4 police officers screened positive for hazardous drinking, 1 in 7 globally met criteria for PTSD and depression, and 1 in 10 met criteria for an anxiety disorder or suicidal ideation. Our findings suggest that the prevalence of mental health problems among police often exceed twice that reported for the general population. Compared to the recent UK Adult Psychiatric Morbidity Survey of the general population (adults aged 16-64 years, n=7,546), we found higher estimates in the police for PTSD (13.7% vs 4.4%), generalised anxiety disorders (10.9% vs 6.6%), depression (14.6% vs 3.8%), suicidal ideation (9.2% vs 3.3%), and hazardous drinking (25.7% vs 16.6%).[119] Contrasted to previous meta-analyses on police, current prevalence estimates also exceed twice that previously reported for PTSD (14.3% vs 4.7%),[21-27] and depression (14.6% vs 7.0%).[120] Overall, these findings indicate that previous studies on mixed first responders underestimate the prevalence of mental problems in the wider police population, and illuminate the critical health care needs of police worldwide.

Higher occupational stress and being female were the most consistent risk factors for poorer mental health among police. The impact of occupational stressors is broadly consistent with Agnew's general strain theory,[121] where repeated negative experiences in absence of occupational rewards are believed to intensify the strain of smaller police stressors (e.g. admin,

caseload). The effect of cumulative strain may also hamper the natural resolution of trauma-related psychological difficulties that otherwise would occur over time in less stressful environments.[122] As police are unique in carrying firearms and responding to violence, additional stress is posed by negative perceptions from peers and the public,[123] along with cultural barriers to help-seeking (i.e. stigma).[124] Similarly, the male dominance and power differences observed between genders in police may put females at a disadvantage of peer support, potentially inferring greater susceptibility for depression and PTSD.[124] Whilst based on a modest pool of findings, the consistency across outcomes highlight that organisational risk factors play a central role in the development of mental health problems in police, rather than the job itself.

Avoidant coping and hazardous drinking were associated with a higher risk for PTSD, supporting previous findings in mixed populations.[125-127] Maladaptive coping strategies have long been emphasised as unique characteristics for vulnerability to stress, potentially disrupting the memory encoding of traumatic events and increasing PTSD risk.[128] However, the cross-sectional nature of the pooled data makes the true drivers of PTSD unclear. Increased avoidance, for example, may be a consequence of coping with trauma. Further longitudinal research on the association between early onset of negative coping strategies and long-term psychiatric conditions are needed.

Limitations

This study has important limitations and estimates should be considered with caution. First, each risk factor was analysed in isolation from other risk factors, affecting the ability to make assumptions about their independent contribution to psychiatric conditions.[129] For example, avoidance might contribute differently to the risk of PTSD when taking into account

organisational stress. Nonetheless, our estimates still provide valuable insights to facilitate preventive strategies to reduce psychological risks. Further, given the high between-study heterogeneity and limited data available on covariance matrixes, there would have been minimal benefits of applying a multivariate approach.[130]

Second, the overall between-study heterogeneity across estimates remained substantial and could not be explained by most subgroup analyses. As in most large meta-analyses, several factors not examined in the subgroup and sensitivity analyses (e.g. culture, mental health awareness, comorbid conditions) may have influenced the variation in our estimates. For instance, our subgroup analyses highlighted that the prevalence of mental health problems in the police was higher in Asia than other continents. Nonetheless, no large-scale police study globally or in the U.S provided nationally representative estimates for reliable cross-country comparisons. The limitations of this heterogeneity, therefore, reflects that the 'best available data' is limited. The consistency of our results across larger samples and sensitivity analyses also suggest that estimates are valid and merit further study.

Third, most studies were cross-sectional and outcomes may, therefore, have been caused by non-police related factors, including prior trauma or military service, or been confounded by lower socioeconomic status.[131, 132] Still, in an attempt to isolate the link between police-related mental health problems we only included studies looking at active police personnel. Additionally, with the exception of a handful of studies on police recruits or disaster workers, no large study provided longitudinal estimates on risk factors for psychiatric disorders in police.

Finally, estimates were mainly obtained using self-report instruments (91%) rather than clinician interviews, with only one identified study using a gold-standard Clinician-Administered

Scale (e.g. CAPS for PTSD).[133] Many studies also lacked details on self-report procedures and we were unable to establish whether PTSD symptoms related to specific events or repeated trauma. However, self-report measures may reflect more accurate estimates than interviews, given their ability to protect anonymity, and the potential stigma of face-to-face questioning among police.[124]

Implications

Despite these limitations, our findings of increased mental health problems among police illustrate that facilitation of early identification and help-seeking for psychiatric conditions is vital for improving officers' quality of life. Continuous mental health screenings and psychoeducation throughout a police career could prove beneficial, as opposed to single screenings after large incidents.[134] The association between social support, generic occupational stress, and decreased psychological difficulties also allude to the benefits of integrating routine peer support and relaxation in police departments. For instance, positive peer and leader attitudes towards mental health have shown to buffer the negative effects of police trauma and job strain.[135, 136] Specific preventative efforts should, therefore, be aimed at minimising negative police cultures via stigma reduction strategies, confidential counselling without supervisory approval, increased employee-assistance programs, and routine psychoeducation.

The limited occupational support is further compounded by inadequate evidence of effective interventions, resulting in a lack of consensus as to what should be offered. To date, two comprehensive Cochrane reviews attest to the inconclusive evidence for police interventions. One review investigated specific police stress intervention studies,[137] and the other examined interventions for stress, burnout and job satisfaction across professions.[138] Both reviews reported

that no intervention study was of adequate quality to include in their synthesis. Another review by the Campbell Collaboration found no evidence for an overall reduction in psychobiological symptoms for police-specific stress interventions.[139] Only one high-quality pilot trial, using combined psychopharmacology, has shown potential effectiveness in reducing psychiatric symptoms among mixed first responders.[140] Other interventions such as Trauma Risk Management or mindfulness have been studied in pre-post designs and shown limited effectiveness.[141] Further research into interventions that address stress and peer support in the police is needed, taking into account risk differences between genders and cultures.

Overall, our results support the increased funding initiative from the U.S National Institute for Occupational Safety and Health, and the UK government's common goals for increasing police wellbeing,[142, 143] to prioritise research on mental health in police and match preventative efforts in other high-risk populations.

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Contributions

Concept: Shabeer Syed, Jo Billings

Design: Shabeer Syed

Drafting of the manuscript: Shabeer Syed, Rachel Ashwick

Acquisition, analysis, or interpretation of data: Shabeer Syed, Rachel Ashwick, Jo Billings, Sarah Rowe, Marco Schlosser, Rebecca Jones

Statistical analysis: Shabeer Syed, Rebecca Jones

Critical revision of the manuscript for important intellectual content: Shabeer Syed, Jo Billings, Rachel Ashwick, Sarah Rowe, Marco Schlosser, Rebecca Jones

Study supervision: Jo Billings (primary), Sarah Rowe (secondary), Rebecca Jones (statistical)

Conflict of interest

All authors declare no competing conflicts of interest.

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Figure captions and legends

Figure 2. Prevalence of PTSD or PTSD symptoms
NR, Not reported. Studies are stratified by screening instrument alphabetically and ordered by increasing sample size. The area of each square is proportional to the double arcsine estimate. Horizontal lines indicate 95% confidence intervals of the estimate. The dashed line marks the overall summary estimate for all studies.

Figure 3. Prevalence of depression or depressive symptoms, and suicidal ideations
NR, Not reported. For each outcome, studies are stratified by screening instrument alphabetically and ordered by increasing sample size. The area of each square is proportional to the double arcsine estimate. Horizontal lines indicate 95% confidence intervals of the estimate. The dashed line marks the overall summary estimate for all studies.

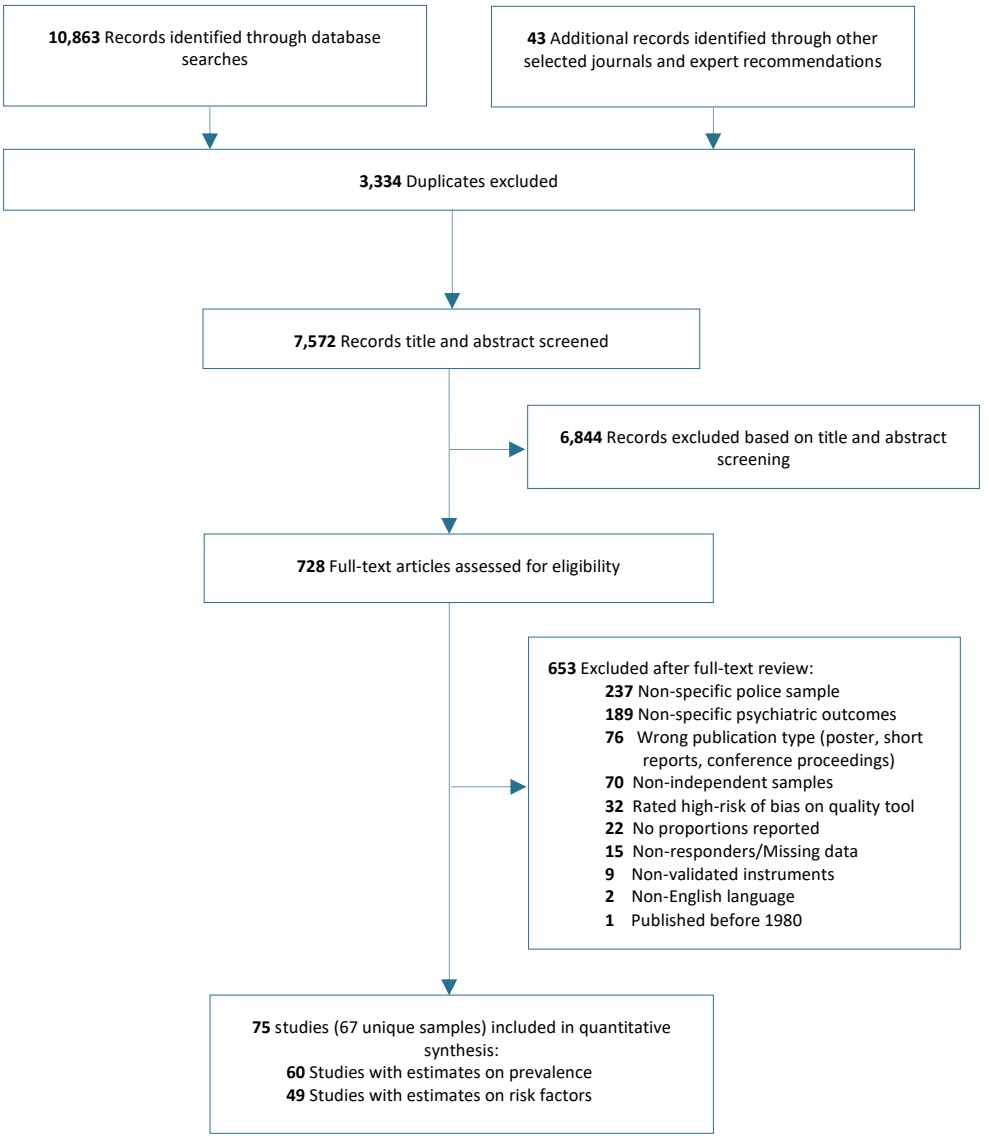
*study used the short form of the Center for Epidemiologic Studies Depression.
†cut-off score based on the upper percentile of the study sample.

Figure 4. Prevalence of an anxiety disorder or anxiety symptoms, hazardous drinking, and alcohol dependence
NR, Not reported. For each outcome, studies are stratified by screening instrument alphabetically and ordered by increasing sample size. The area of each square is proportional to the double arcsine estimate. Horizontal lines indicate 95% confidence intervals of the estimate. The dashed line marks the overall summary estimate for all studies.

*cut-off scores based on normative table of the general Dutch population Cut-off score based on.
†cut-off score based on the upper percentile of the study sample.
‡Study omitted item 2 from the instrument and therefore used a lower cut-off score
§≥4 cut-off score for males and 3 ≥ cut-off score for females.

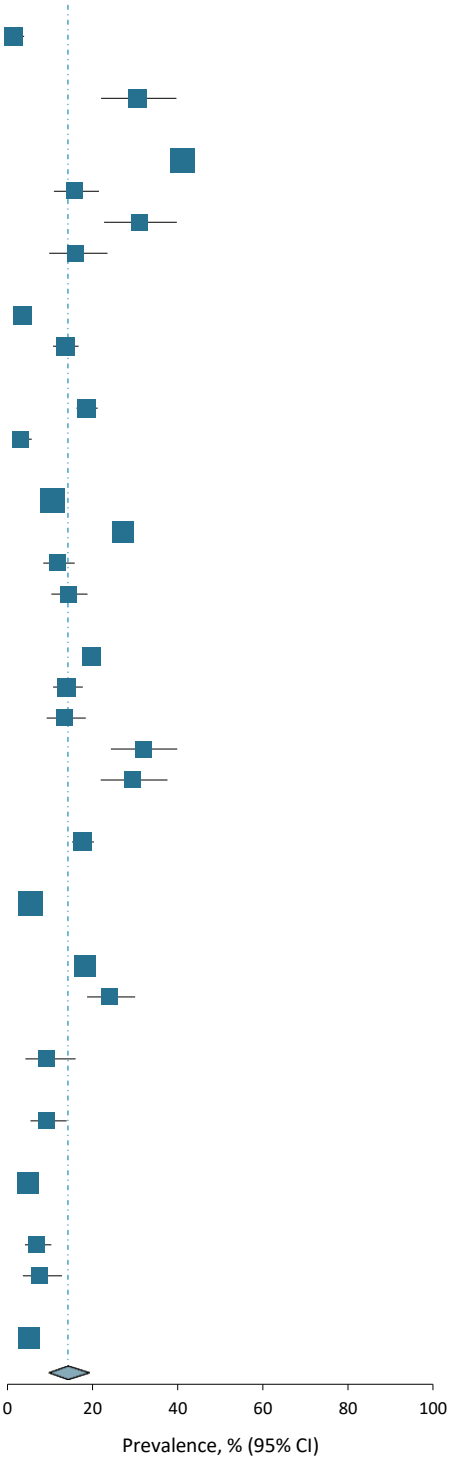
Figure 5. Pooled estimates for risk factors of mental health problems among police personnel
Pooled estimates are based on random-effects meta-analyses of the log odds ratio unless otherwise stated. Horizontal lines indicate 95% confidence intervals of the estimate. The dashed line marks the estimate for no association. Individual study estimates are provided in supplementary figures S9-S12.

*Estimates based on a fixed-effects meta-analysis due to lower between-study heterogeneity.


10,863 Records identified through database searches
43 Additional records identified through other selected journals and expert recommendations
3,334 Duplicates excluded
7,572 Records title and abstract screened
6,844 Records excluded based on title and abstract screening
728 Full-text articles assessed for eligibility
653 Excluded after full-text review:
237 Non-specific police sample
189 Non-specific psychiatric outcomes
76 Wrong publication type (poster, short reports, conference proceedings)
70 Non-independent samples
32 Rated high-risk of bias on quality tool
22 No proportions reported
15 Non-responders/Missing data
9 Non-validated instruments
2 Non-English language
1 Published before 1980
75 studies (67 unique samples) included in quantitative synthesis:
60 Studies with estimates on prevalence
49 Studies with estimates on risk factors

Sources & Instrument	Cut-off score ≥	Cases/N	Prevalence (95%CI)	Weight, %
Davidson Trauma Scale				
Gabriel, 2007	40	2/153	1.3 (0.0-3.9.0)	3.4
Impact Event Scale				
Andrew, 2008	26	32/105	30.5 (22.0-39.7)	3.3
Impact Event Scale-Revised				
Lee, 2016a	26	1569/3817	41.1 (39.5-42.7)	3.7
Chopko, 2010	33	29/183	15.8 (10.9-21.5)	3.4
Regehr, 2013	33	35/113	31.0 (22.7-39.8)	3.3
Lee, 2016b	25	18/112	16.1 (9.8-23.5)	3.3
Mississippi PTSD Scale Civilian Version				
Ballenger, 2011	94	25/712	3.5 (2.3-5.0)	3.5
Stephens, 1998	96	69/508	13.6 (10.7-16.7)	3.5
PTSD Checklist				
West, 2008	NR	170/912	18.6 (16.2-21.2)	3.5
Skogstad, 2016	35	8/253	3.2 (1.3-5.7)	3.4
PTSD Checklist-5				
Kyron, 2019	NR	806/8088	10.0 (9.2.1-10.6)	3.7
Carleton, 2018	33	718/2653	27.1 (25.4-28.8)	3.6
Soomro, 2018	33	35/296	11.8 (8.4-15.8)	3.4
Galovski, 2016	38	37/259	14.3 (10.3-18.8)	3.4
PTSD Checklist-Civilian Version				
Ménard, 2014	NR	261/1323	19.7 (17.6-21.9)	3.5
Violanti, 2016	35	53/378	14.0 (10.7-17.7)	3.5
Kerswell, 2019	30	29/215	13.5 (9.2-18.4)	3.4
Asmundson, 2008	44	44/138	31.9 (24.3-39.9)	3.3
Seigfried-Spellar, 2017	30	38/129	29.5 (21.9-37.6)	3.3
PTSD Checklist-Military Version				
Oehme, 2012	50	151/853	17.7 (15.2-20.3)	3.5
PTSD Checklist-Specific Version				
Pietrzak, 2012	50	455/8466	5.4 (4.9-5.9)	3.7
Posttraumatic Diagnostic Scale				
Lee, 2014	11	483/2652	18.2 (16.8-19.7)	3.6
Steyn, 2009	NR	53/220	24.1 (18.7-30)	3.4
PTSD Scale-Self Report				
Jones, 2005	36	9/97	9.3 (4.2-16.0)	3.1
Primary Care-PTSD Screen				
Mumford, 2015	3	17/184	9.2 (5.4-13.9)	3.4
Posttraumatic Symptom Scale				
Ellrich, 2012	36	109/2215	4.9 (4.1-5.9)	3.6
Structured Clinical Interview DSM-III-R/DSM–IV				
Carlier, 1997	-	18/262	6.9 (4.1-10.3)	3.4
Martin, 2009	-	10/132	7.6 (3.6-12.8)	3.3
Self-Rating Inventory PTSD				
Witteveen, 2007	39	74/1468	5.0 (4.0-6.2)	3.6
Pooled summary estimate:		5357/36896	14.2 (10.3-18.7)	
Prediction interval:			[0.1-44.2]	

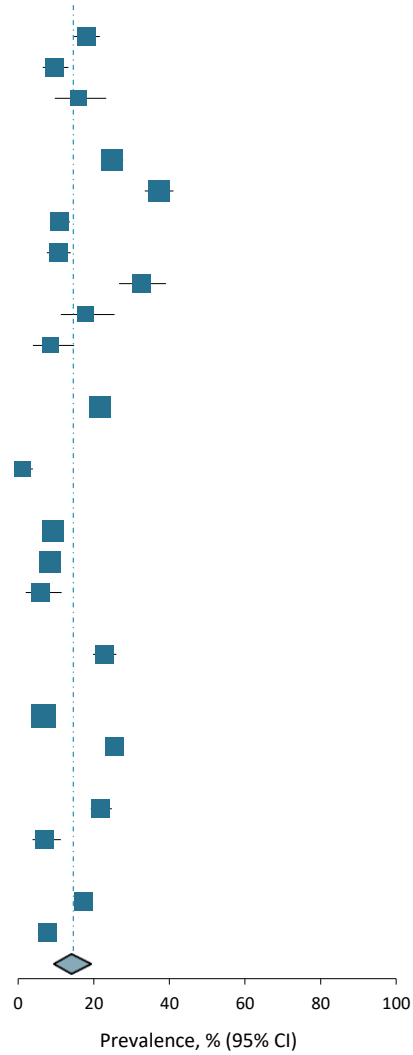
Heterogeneity: k=29, I^2= 99.2 %, τ^2=0.026, Q=3397.2, P<0.001



A.

Sources & Instrument	Cut-off score ≥	Cases/N	Prevalence (95%CI)	Weight, %
Beck Depression Inventory				
Kutlu, 2009	17	89/492	18.1 (14.8-21.6)	4.6
Garbarino, 2013	10	28/292	9.6 (6.5-13.3)	4.5
Regehr, 2013	14	18/113	15.9 (9.7-23.3)	4.2
Center for Epidemiological Studies-Depression				
West, 2008	22	227/912	24.9 (22.1-27.8)	4.7
Lawson, 2012	9*	235/631	37.2 (33.5-41.1)	4.7
Hartley, 2012	16	59/540	10.9 (8.4-13.7)	4.6
Everding, 2016	16	40/379	10.6 (7.6-13.9)	4.6
Galovski, 2016	16	72/220	32.7 (26.7-39.1)	4.5
Lee, 2016b	25	20/112	17.9 (11.3-25.5)	4.2
Andrew, 2008	16	9/105	8.6 (3.9-14.8)	4.2
Disaster-Related Psychological Screening Test				
Chen, 2006	NR	180/832	21.6 (18.9-24.5)	4.7
MINI International Neuropsychiatric Interview				
Gabriel, 2007	-	2/153	1.3 (0.0-3.9)	4.3
Hospital Anxiety and Depression Scale				
Berg, 2006	8	305/3272	9.3 (8.3-10.3)	4.7
Tuohy, 2005	11	112/1334	8.4 (7.0-9.9)	4.7
Hurrell, 2018	11	6/101	5.9 (2.0-11.5)	4.1
Peradeniya Depression Scale				
Wickramasinghe, 2016	10	162/709	22.8 (19.8-26)	4.7
Patient Health Questionnaire -9				
Pietrzak, 2012	10	569/8466	6.7 (6.2-7.3)	4.8
Carleton, 2018	10	713/2791	25.5 (23.9-27.2)	4.7
Patient Health Questionnaire -2				
Santa Maria, 2017	3	185/843	21.9 (19.2-24.8)	4.7
Mumford, 2015	3	13/184	7.1 (3.8-11.3)	4.4
Symptom Checklist-90-Revised				
Huizink, 2006	65th†	255/1468	17.4 (15.5-19.3)	4.7
van der Velden, 2013	95th†	51/647	7.9 (5.9-10.1)	4.7
Pooled summary estimate:		3350/24596	14.6 (10.9-18.6)	
Prediction interval:			[1.3-37.9]	

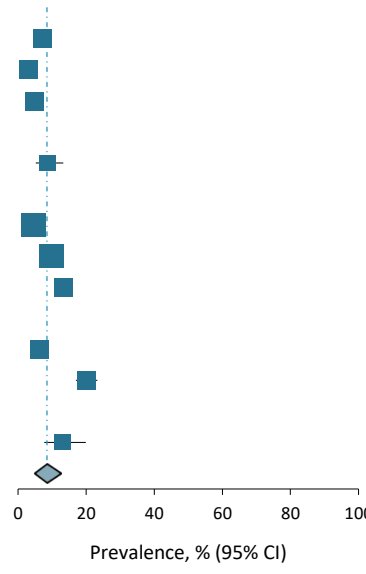
Heterogeneity: k=22, I^2= 98.4%, τ^2=0.016, Q=1343.0, P<0.001



B.

Source & Instrument	Cut-off score ≥	Cases/N	Prevalence, % (95% CI)	Weight, %
Adult Suicidal Ideation Questionnaire				
Pienaar, 2007	31	132/1794	7.4 (6.2-8.6)	10.8
Wray, 2019	31	9/305	3.0 (1.3-5.2)	9.5
Meyer, 2003	NR	14/299	4.7 (2.5-7.4)	9.4
General Health Questionnaire-28 four-item-SI				
Chopko, 2014	2	17/193	8.8 (5.2-13.3)	8.7
Ideation past 12-mo				
Harman, 2019	-	403/8581	4.7 (4.3-5.2)	11.0
Carleton, 2018b	-	511/5148	9.9 (9.1-10.8)	11.0
Bishopp, 2014	-	189/1410	13.4 (11.7-15.2)	10.7
Paykel Suicide Scale				
Berg, 2003	NR	194/3046	6.4 (5.5-7.3)	10.9
Burke, 2007	NR	124/619	20 (17-23.3)	10.2
Suicide Behaviors Questionnaire-Revised				
Thoen, 2019	NR	16/121	13.2 (7.7-19.9)	7.8
Pooled summary estimate:		1609/21516	8.5 (6.1-11.2)	
Prediction interval:			[1.5-20.2]	

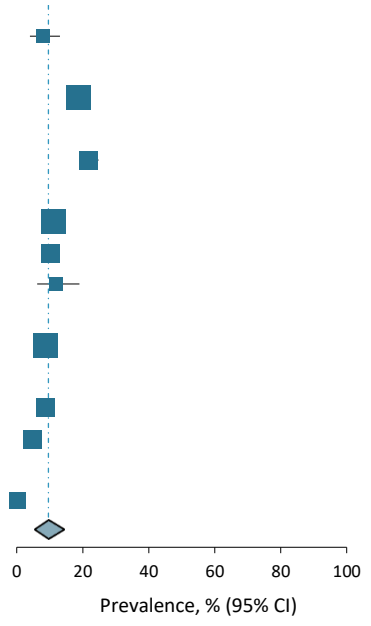
Heterogeneity: k=10, I^2= 97.2%, τ^2=0.005, Q=322.4, P<0.001



A.

Sources & Instrument	Cut-off score ≥	Cases/N	Prevalence (95%CI)	Weight, %
Anxiety Sensitivity Index				
Asmundson, 2008	11	11/138	8.0 (4.0-13.1)	8.5
Generalized Anxiety Disorder Assessment				
Carleton, 2018	10	516/2730	18.9 (17.5-20.4)	10.7
Generalized Anxiety Disorder Scale 2-Items				
Santa Maria, 2017	3	185/843	21.9 (19.2-24.8)	10.4
Hospital Anxiety and Depression Scale				
Berg, 2006	8	366/3272	11.2 (10.1-12.3)	10.7
Tuohy, 2005	11	138/1334	10.3 (8.8-12.0)	10.5
Hurrell, 2018	11	12/101	11.9 (6.2-19.0)	7.9
Patient Health Questionnaire				
Pietrzak, 2012	NR	739/8466	8.7 (8.1-9.3)	10.8
Symptom Checklist-90-Revised				
Witteveen, 2007	Norm*	128/1468	8.7 (7.3-10.2)	10.6
van der Velden, 2013	80th†	31/647	4.8 (3.3-6.6)	10.2
State-Trait Anxiety Inventory				
Garbarino, 2013	40	1/292	0.3 (0.0-1.5)	9.6
Pooled summary estimate:		2127/19291	9.6 (6.72-12.93)	
Prediction interval:			[1.3-24.1]	

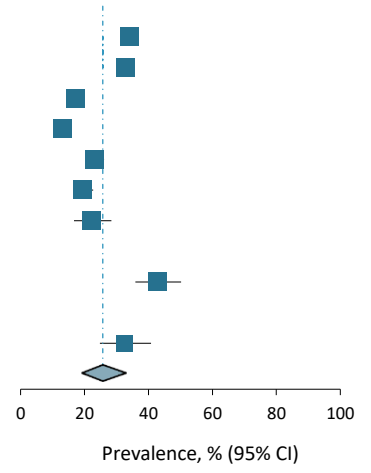
Heterogeneity: k=10, I^2= 97.7%, τ^2=0.007, Q=387.9, P <0.001



B.

Sources & Instrument	Cut-off score ≥	Cases/N	Prevalence (95%CI)	Weight, %
Alcohol Use Disorders Identification Test				
Davey, 2000	8	1384/4193	33.0 (31.6-34.4)	11.6
Lee, 2014	8	903/2652	34.0 (32.3-35.9)	11.6
Sterud, 2007	6‡	410/2372	17.3 (15.8-18.8)	11.6
Ménard, 2014	8	179/1355	13.2 (11.5-15.1)	11.5
Oehme, 2012	8	198/853	23.2 (20.4-26.1)	11.4
Lindsay, 2008b	8	118/606	19.5 (16.4-22.7)	11.2
Chopko, 2013	8	43/193	22.3 (16.7-28.4)	10.5
Alcohol Use Disorders Identification Test-C				
Mumford, 2015	4/3§	79/184	42.9 (35.9-50.2)	10.5
Michigan Alcohol Screening Test				
Komarovskaya, 2011	1	43/132	32.6 (24.8-40.8)	10.1
Pooled summary estimate:		3357/12540	25.7 (19.6-32.4)	
Prediction interval:			[6.5-52.0]	

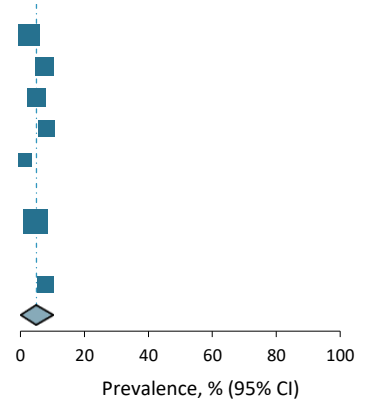
Heterogeneity: k=9, I^2= 98.3%, τ^2=0.012, Q=477.6, P<0.001



C.

Sources & Instrument	Cut-off score ≥	Cases/N	Prevalence (95%CI)	Weight, %
Alcohol Use Disorders Identification Test				
Davey, 2000	14	115/4193	2.7 (2.3-3.3)	15.1
Lee, 2014	16	200/2652	7.5 (6.6-8.6)	14.8
Carleton, 2018	16	125/2574	4.9 (4.1-5.7)	14.7
Oehme, 2012	16	70/853	8.2 (6.5-10.1)	13.7
Lindsay, 2008	16	8/606	1.3 (0.5-2.4)	13.0
CAGE Questionnaire				
Pietrzak, 2012	2	404/8466	4.8 (4.3-5.2)	15.3
Michigan Alcohol Screening Test				
Ballenger, 2011	7	56/712	7.9 (6.0-10.0)	13.4
Pooled summary estimate:		978/20056	5.0 (3.5-6.7)	
Prediction interval:			[0.9-12.2]	

Heterogeneity: k=7, I^2= 95.7%, τ^2=0.002, Q=138.5, P<0.001



Outcome	Risk factor	Studies	Sample size	Pooled OR (95% CI)	*P*-value	*Q*	I^2
PTSD	Avoidant coping	6	2503	3.91 (1.19-12.84)	0.025	207.9	97.6
	Occupational stress	8	12076	3.50 (2.60-4.72)	0.000	59.4	88.2
	Alcohol consumption	4	10754	2.44 (1.34-4.42)	0.003	29.7	89.9
	Trauma frequency	9	19626	2.03 (1.41-2.92)	0.000	174.0	95.4
	Being female	8	19186	1.56 (1.11-2.18)	0.010	126.3	94.5
	Older age, years	10	12733	1.56 (0.94-2.58)	0.083	377.3	97.6
	Time in policing, years	6	1998	1.41 (1.01-1.95)	0.041	11.8	57.7
	Higher education, years*	6	9660	0.92 (0.78-1.09)	0.333	9.38	46.7
	Active coping	5	1066	0.71 (0.08-5.98)	0.753	259.4	98.5
	Peer-support	4	9796	0.65 (0.43-0.99)	0.042	21.6	86.1
	Generic social support	7	10720	0.53 (0.53-1.02)	0.056	106.6	94.4
Depression	Occupational stress	8	19492	3.74 (2.70-5.18)	0.000	130.3	94.6
	Being female*	3	9384	2.09 (1.93-2.26)	0.000	0.5	0.0
	Trauma frequency	3	1086	1.90 (0.32-11.18)	0.261	17.0	88.3
	Time in policing, years*	3	1114	1.25 (0.98-1.61)	0.078	3.6	44.0
	Older age, years	5	17816	1.05 (0.77-1.44)	0.750	86.0	95.3
Hazardous or increasing risk drinking	Trauma frequency	5	2597	1.67 (0.84-5.47)	0.296	45.8	91.3
	Being male*	5	8878	1.49 (1.29-1.71)	0.000	5.7	29.5
	Occupational stress	4	1801	1.47 (0.96-2.26)	0.079	11.1	72.9
Suicidal ideation	Occupational stress*	4	3696	1.72 (1.52-1.93)	0.000	5.9	48.8
	Older age, years	3	8387	1.08 (0.31-3.76)	0.812	6.8	70.5