Psychosocial job stressors and suicidality: a meta-analysis and systematic review

Allison Milner,1,2 Katrina Witt,3 Anthony D LaMontagne,1,2 Isabelle Niedhammer4,5

ABSTRACT

Objectives Job stressors are known determinants of common mental disorders. Over the past 10 years, there has been evidence that job stressors may also be risk factors for suicidality. The current paper sought to examine this topic through the first comprehensive systematic review and meta-analysis of the literature to date.

Methods We used a three-tier search strategy of seven electronic databases. Studies were included if they reported on a job stressor or job-related stress as an exposure and suicide ideation, self-harm, suicide attempt or suicide as an outcome. Two researchers independently screened articles. All extracted effect estimates were converted to log-transformed ORs.

Results There were 22 studies that were included in meta-analysis. Overall, exposure to job stressors was associated with elevated risk of suicide ideation and behaviours. The OR for suicide ideation (14 studies) ranged from 1.45 (95% CI 1.01 to 2.08) for poor supervisor and colleague support to 1.91 (95% CI 1.01 to 3.57) for job insecurity. For suicide (six studies), exposure to lower supervisor and collegial support produced an OR of 1.16 (95% CI 0.98 to 1.38), while low job control resulted in an OR of 1.23 (95% CI 1.00 to 1.50). There were only two studies that examined suicide attempt, both of which suggested an adverse effect of exposure to job stressors.

Conclusions This study provides some evidence that job stressors may be related to suicidal outcomes. However, as most studies in the area were cross-sectional and observational in design, there is a need for longitudinal research to assess the robustness of observed associations.

INTRODUCTION

The psychosocial conditions in which people are employed are recognised social determinants of health. Common adverse psychosocial working conditions include low job control (characterised as a limited ability to learn new things or develop skills and lack of decision-making ability) and high job demands (characterised as excessive amount of work and work pressure). Another prominent stressor is effort–reward imbalance, which arises from an imbalance between high extrinsic effort by workers (eg, pressure to work overtime, increasingly demanding work, constant time pressure and repeated interruptions) and the perception of low rewards financially (income), socially (respect and esteem) and organisationally (job security and promotion prospects). Job insecurity is a common job stressor and is defined as the perceived threat of job loss and the worries related to that threat.

Exposure to poor working conditions, such as low job control, high demands and effort–reward imbalance, have been associated with poor mental health across a range of studies. There is also evidence from observational studies that improvement in psychosocial conditions are associated with better mental health. Thus, there is some evidence that these are modifiable factors and that acting on these has the potential to lead to improvements in mental health. Close to 10 years ago, a number of researchers provided evidence about the possibility that adverse working environments could also comprise risk factors for suicide. Since this time, there have been a number of papers on the topic, all of which have supported the idea that poor working conditions are related to risk of suicide ideation and suicide death. In addition to this, there is evidence to suggest that suicide rates are higher in occupations with poorer working conditions (eg, construction workers, labourers, forestry workers and agricultural workers and police) than occupations where the overall psychosocial environment is more positive (eg, professionals, managers and other highly skilled jobs). While there have been a number of studies on the relationship between psychosocial job stressors and suicide, these have tended to be based on limited sample sizes, which has limited statistical power to detect effects. Considering the substantial amount of policy and research on the relationship between psychosocial job stressors and suicidality in recent years, we sought to examine the full evidence base on this topic through systematic review and meta-analysis, thereby building on past narrative reviews. In this review, therefore, we sought to investigate whether exposure to job stressors was associated with a greater risk of suicidal ideation and/or behaviours.

METHODS

The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Search strategy and keywords

We conducted a systematic search of seven electronic databases that index literature from a wide range of disciplines including medical science (Embase, PubMed and Web of Science), public health (Global Health), psychology (PsycINFO) and social science (ProQuest and Scopus). All databases were searched for eligible studies from their start date until 30 January 2017.

We used a three-tier search strategy to identify eligible studies. At the first stage, keywords
related to psychosocial job stressors and working contexts were combined (eg, ‘job stress’ OR ‘psychosocial job stress’ OR ‘working condition’). We then searched for common terms for psychosocial job stressors (eg, ‘job control’ OR ‘job demands’ OR ‘job secure’ OR ‘job insecure’). At the third stage, we searched for keywords inclusive of self-harm or suicide (eg, ‘selfharm’ OR ‘suicide’ OR ‘attempts suicid*’ OR ‘suicid* thought*’). We then conducted a search incorporating the search terms from tiers one, two and three using standard Boolean operators. A full list of the keywords can be seen in online supplementary file 1.

Keywords were adapted for the specific requirements of each electronic database. Truncation and wildcards were introduced where necessary to increase the sensitivity of the search. No restrictions were placed on publication status or language, but if we were unable to obtain adequate details for data extraction, these were later excluded from meta-analyses.

Reference lists of identified studies as well as prior relevant reviews in the field were also hand screened to identify further relevant studies. Experts in the field were also contacted to assist with the identification of ongoing evaluations.

INCLUSION AND EXCLUSION CRITERIA
Studies were included in the review provided they satisfied the following inclusion criteria: included a job stressor or job-related stress as exposures or risk factors and included suicide ideation, self-harm, suicide attempt or suicide as an outcome (either as a primary or secondary outcome). Studies were also included that used the following designs: prospective cohort, case-control, retrospective mortality, cross-sectional or intervention trial (eg, either predesign or postdesign, or randomised controlled trial).

Studies investigating associations with physical, ergonomic and/or chemical exposures were excluded. Case reports, qualitative papers, study protocols and/or descriptions were also excluded as these did not report quantifiable data on suicide-related outcomes that could be used in meta-analysis. We also excluded studies that reported on suicide rates within specific occupational groups if these did not also provide a measure of psychosocial job stressors. Finally, we also excluded studies that specifically examined bullying and harassment as predictors of suicide, given that there has been a recent review on this topic.

Titles and abstracts of retrieved records were evaluated using a two-stage screening process. At the first stage, studies with relevant titles were selected for second screening by two of the authors working independently of one another (AM and KW). At the second stage, only those studies satisfying inclusion criteria following a review of the full text were retained. Disagreements were resolved by consensus between two of the review authors (AM and KW).

Data extraction
Methodological information extracted from each study included the location of the study, time period the study was conducted, author names, description of studied sample, study design, exposure definition and outcome definition. For each exposure, effect sizes were recoded so that higher values represent greater exposure to poorer psychosocial job stressors. Data extraction was checked for accuracy between three authors working independently (KW, AM and IN).

All effect size estimates were considered, including odds ratios (ORs), rate ratios, relative risks and correlation coefficients. However, raw data were extracted as a preference over aggregated effect measures to enable estimation of unadjusted associations between each psychosocial job stressor and suicidality. Estimates needed to present either an SE or 95% CIs to be included in meta-analyses. Alternatively, studies needed to provide raw data so that the SE and CIs could be calculated.

Statistical analysis
Data were pooled between studies using the OR and its 95% CI. This necessitated conversion between the different effect size statistics reported in the original studies. Specifically, for continuous outcomes, we converted data presented as Pearson’s correlation to a standardised mean difference using guidance from Borenstein, which then allowed us to convert the standardised mean difference to an OR. All ORs were coded so that higher scores represented greater exposure to poorer psychosocial job stressors.

All ORs and their 95% CIs were log-transformed to allow for meta-analysis. The pooled OR represents the risk of suicide associated with the exposure of interest (eg, each job stressor) compared with those who were not exposed to this stressor. Where possible, we conducted separate analyses for males and females.

Heterogeneity between studies was assessed through the $I^2$ statistic that indicates the percentage of variability in effect sizes due to methodological or statistical differences between the studies included in a meta-analysis. We also used meta-regression to assess the extent to which statistical heterogeneity results of studies were related to study characteristics. Funnel plots were also used to assess small study effects. All analyses were conducted using Stata for Windows, V14.1, using the ‘metan’ and ‘metareg’ packages.

RESULTS
A total of 4644 records were identified following the systematic search strategy outlined above. A further three were obtained following correspondence with researchers working in the area. Following deduplication, this was reduced to 4334. Of these, 4247 were excluded at the first screening stage, and a further 59 were excluded following application of the inclusion and exclusion criteria at the second screening stage. A total of 25 records were therefore included in the present review comprising 22 independent, non-overlapping studies (figure 1). Of these, we were able to extract data from 22 studies for quantitative meta-analysis.

Study characteristics
These 22 studies have been conducted in a variety of locations, including Germany, Norway, South Korea, the USA, France, China (Hong Kong Special Administrative Region), Australia, Canada and Sweden. There were two studies that reported data from more than one sample, one study reported data from Italy and Sweden and the second included data from Australia, China, Germany and South Korea.

A number of studies covered a range of specific groups, most notably medical doctors, followed by sawmill workers, police, firefighters, medical students, nurses, textile workers, industrial workers, retail sales workers and subway drivers. The remaining studies covered the general working population. The earliest study was published in 1999, and the latest was published in 2017. The majority of the 22 studies investigated associations with suicide ideation.
Seventeen studies investigated a wide range of psychosocial job stressors, including poor colleague or supervisor support, low job control, high psychological job demands, effort–reward imbalance, job insecurity, role conflict, long working hours and shift work. There were a number of studies that did not report specific psychosocial job stressors, but rather reported associations with a measure of ‘general’ self-reported job stress, which is more proximal to suicidality than job stressor exposures, as job-related stress or distress is a response to job stressors, while smaller numbers assessed suicide death only, with an elevated odds of suicide ideation. The OR ranged from 1.45 (95% CI 1.01 to 2.08) for poor supervisor and colleague support, to 1.91 (95% CI 1.18 to 2.12) and low job control (1.04, 95% CI 1.04 to 1.04) were associated with an increased odds of suicide attempt. One other study found that general self-reported job-related stress was associated with higher risk of suicide attempt (2.62, 95% CI 2.19 to 3.13). Exposure to any job stressor was associated with an OR of 1.17 (95% CI 1.11 to 1.24).

Suicide ideation
Figure 2 shows the results for different exposures and suicide ideation. Across all psychosocial exposures, there was an elevated odds of suicide ideation. The OR ranged from 1.45 (95% CI 1.01 to 2.08) for poor supervisor and colleague support, to 1.91 (95% CI 1.18 to 2.12) and low job control (1.04, 95% CI 1.04 to 1.04) were associated with an increased odds of suicide attempt. One other study found that general self-reported job-related stress was associated with higher risk of suicide attempt (2.62, 95% CI 2.19 to 3.13). Exposure to any job stressor was associated with an OR of 1.17 (95% CI 1.11 to 1.24).

Suicide attempt
We identified only single studies of specific jobs stressors in relation to suicide attempts, precluding meta-analyses for this outcome. In one study, exposure to poor colleague and supervisor support (OR 1.19, 95% CI 1.18 to 1.21) and low job control (1.04, 95% CI 1.04 to 1.04) were associated with an increased odds of suicide attempt. One other study found that general self-reported job-related stress was associated with higher risk of suicide attempt (2.62, 95% CI 2.19 to 3.13). Exposure to any job stressor was associated with an OR of 1.17 (95% CI 1.11 to 1.24).

Suicide death
Figure 3 shows the results for suicide death for males, females and all persons. There was a higher risk of suicide associated with lower supervisor and collegial support (OR 1.16, 95% CI 0.98 to 1.38) and low job control (OR 1.23, 95% CI 1.00 to 1.50). There were no significant associations between job demands or job strain and suicide death. Although not included in figure 3, we also calculated a pooled effect for general self-reported job-related stress from two studies (OR 1.48, 95% CI 0.94 to 2.32, I² 29.0%). Exposure to any job stressor was associated with an OR of 1.17 (95% CI 1.03 to 1.34). As we note above, it is necessary to acknowledge the large number of different exposures that was included in this analysis.

As a sensitivity analysis, we removed females from this analysis, given that the epidemiology of suicide is vastly different for males and females. This may have affected the result for job demands, which was non-significantly associated with death for males (OR 1.16, 95% CI 0.57 to 2.36, I² 88.5%). The OR for colleague and supervisor support decreased to 1.09 (95% CI 0.89 to 1.33, I² 98.6%), while the OR for job control increased to 1.29 (95% CI 1.19 to 1.40, I² 100%) for males only. Meta-regression indicated that a large part of the between study variance is driven by the difference in study populations (eg, occupational vs general cohort) (36.95%), country (23.11%) and study design (21.62%). In particular, results regarding study design found that cross-sectional studies were much more likely to identify a significant and positive association between job stressors and suicidality than other designs. A much smaller proportion of the between study variance was driven by gender (3.25%) or year (1.85%). Funnel plots for suicide ideation and deaths can be found in online supplementary file 2. These suggest that analysis was potentially affected by an absence of studies finding non-significant associations between exposure to adverse psychosocial working conditions and suicidal ideation and/or behaviour. As a final sensitivity analysis, we removed Wall et al from the analysis of working hours as this represented work–family conflict. Pooled results were largely unchanged (OR 1.69, 95% CI 0.85 to 3.34).

DISCUSSION
Our review included 22 independent studies, which examined suicide ideation, suicide attempt and death by suicide. The studies included a wide range of sample types (eg, occupation specific vs working population based) and were set in a diverse range of countries. Across this broad range of studies, results of this review suggest that exposure to various psychosocial job stressors was associated with elevated risk of suicide ideation, attempts and death. Job insecurity was associated with higher odds of suicide ideation, while job control appeared to be more of a risk for suicide attempt and death.

There were a number of limitations that must be taken into consideration when interpreting these results. While we assessed a wide range of job stressors in this review, it was not feasible to include all possible adverse experiences at work. The studies identified by our search strategy mainly focused on modifiable
### Table 1 Descriptive characteristics of studies included in the study

<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Sample under study</th>
<th>Total sample size</th>
<th>Design</th>
<th>Exposure</th>
<th>Outcome</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baumert et al, 2014, Germany</td>
<td>General population</td>
<td>6817</td>
<td>Cohort</td>
<td>Poor psychosocial working conditions ► adverse chronobiological/physical working conditions ► psychosocial working conditions Job strain</td>
<td>Suicide death</td>
<td>Sig+suicide in relation to poor psychosocial working conditions Sig – in relation to job strain</td>
</tr>
<tr>
<td>Berg et al, 2006, Norway</td>
<td>Police</td>
<td>3272</td>
<td>Cross-sectional survey</td>
<td>Poor psychosocial working conditions ► serious operational tasks Social support Job demands ► job pressure</td>
<td>Suicide ideation</td>
<td>Sig – job demand NS Sig+social support and psychosocial working conditions</td>
</tr>
<tr>
<td>Byun et al, 2016, Korea</td>
<td>Subway drivers</td>
<td>980</td>
<td>Cross-sectional survey</td>
<td>Job demands Effort reward imbalance ► lack of reward General job stress ► occupational climate Job insecurity</td>
<td>Suicide ideation</td>
<td>NS+job demands Sig+effort reward NS change general job stress NS+job insecurity</td>
</tr>
<tr>
<td>Carpenter et al, 2015, USA</td>
<td>Professional firefighters</td>
<td>315</td>
<td>Cross-sectional survey</td>
<td>Colleague/supervisor support General job stress ► occupational stress</td>
<td>Suicide ideation</td>
<td>Sig+poor social support Sig+general job stress</td>
</tr>
<tr>
<td>Daglish et al, 2015</td>
<td>General population</td>
<td>1128</td>
<td>Cross-sectional survey</td>
<td>Job insecurity Job strain</td>
<td>Suicide ideation</td>
<td>Sig+job insecurity NS – job strain</td>
</tr>
<tr>
<td>Frank et al, 1999, USA</td>
<td>Female doctors</td>
<td>4287</td>
<td>Cross-sectional survey</td>
<td>Job control Job demands ► work amount General job stress ► work stress</td>
<td>Suicide attempt</td>
<td>Sig+high job demands Sig+general job stress</td>
</tr>
<tr>
<td>Fridner et al, 2011, Italy/ Sweden</td>
<td>Male doctors</td>
<td>241 Italy, 456 Sweden</td>
<td>Cross-sectional survey</td>
<td>Colleague/supervisor support ► discussion about experiences at work ► support at work Job control ► control over work hours ► influence at work Role stressors ► role conflict Working hours/shift work Total work hours/week Night call</td>
<td>Suicide ideation</td>
<td>Sig+poor social support Sig+low job control Sig+general job stress</td>
</tr>
<tr>
<td>Law et al, 2014, Hong Kong</td>
<td>General population</td>
<td>175</td>
<td>Case–control</td>
<td>Job insecurity ► in danger of losing job/demotion ► changes in workplaces Pay changes ► pay cut ► pay freeze</td>
<td>Suicide death</td>
<td>NS – job insecurity NS – pay changes</td>
</tr>
<tr>
<td>Loerbroks et al, 2016, Multicountry</td>
<td>Australian general working population, Chinese nurses, Chinese textile workers, German industrial workers, German physicians, Korean metro workers</td>
<td>3923</td>
<td>Cross-sectional survey</td>
<td>Job control Job demands Effort–reward imbalance Job strain</td>
<td>Suicide ideation</td>
<td>Difference across countries (Sig and NS+) low job control Difference across countries (Sig and NS+) high job demands Difference across countries (Sig and NS+) effort reward imbalance Difference across countries (Sig and NS+) job strain</td>
</tr>
<tr>
<td>McLean et al, 2017, USA</td>
<td>Military personnel with post-traumatic stress disorder</td>
<td>366</td>
<td>Cross-sectional survey</td>
<td>Job demands</td>
<td>Suicide ideation</td>
<td>Sig+low social support</td>
</tr>
<tr>
<td>Milner et al, 2017, Australia</td>
<td>General male population</td>
<td>11862</td>
<td>Cross-sectional survey</td>
<td>Job control Effort reward imbalance Job insecurity</td>
<td>Suicide ideation</td>
<td>Sig+high job demands Sig+effort reward imbalance Sig+job insecurity</td>
</tr>
<tr>
<td>Milner et al, 2016a, Australia</td>
<td>General population</td>
<td>817</td>
<td>Cross-sectional survey</td>
<td>Job demands Job control Colleague/supervisor support Job insecurity</td>
<td>Suicide ideation</td>
<td>NS+job demands Sig+low job control Sig+social support Sig+job insecurity</td>
</tr>
</tbody>
</table>

*continued*
task-based stressors, most of which are likely to represent chronic rather than episodic conditions occurring in workplaces. Other stressors that occur in workplace settings that we did not include in this review include bullying and harassment, which have been shown to be related to suicidality in a recent systematic review. There may be other, more acute stressors that increase the risk of suicide not considered in this review, such as workplace restructuring or exposure to traumatic incidents at work (such as those experienced by police, firefighters and other emergency responders). Considering this, our review undoubtedly underestimates the complexity of the workplace and the influence it may have on a person who thinks about, attempts and/or dies by suicide.

It is also notable that the majority of our studies came from high-income countries. There is a need for more research on the relationship between work and suicide (and mental health

<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Sample under study</th>
<th>Total sample size</th>
<th>Design</th>
<th>Exposure</th>
<th>Outcome</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milner et al, 2016b, Australia</td>
<td>General population</td>
<td>23017</td>
<td>Case-control study</td>
<td>Job control</td>
<td>Suicide death</td>
<td>Sig+low job control (males)</td>
</tr>
<tr>
<td>Ostry et al, 2007, Canada</td>
<td>Male sawmill workers</td>
<td>28794</td>
<td>Cohort study</td>
<td>Job control</td>
<td>Suicide attempt</td>
<td>NS+low social support (death)</td>
</tr>
<tr>
<td>Schneider et al, 2011, Germany</td>
<td>General population</td>
<td>285</td>
<td>Case-control study</td>
<td>Colleague/supervisor support</td>
<td>Suicide death</td>
<td>Sig+low job control</td>
</tr>
<tr>
<td>Sugawara et al, 2012, Japan</td>
<td>General population (40–60 years)</td>
<td>5878</td>
<td>Cross-sectional survey</td>
<td>Job control</td>
<td>Suicide ideation</td>
<td>Sig+low job control</td>
</tr>
<tr>
<td>Takada et al, 2009, Japan</td>
<td>General population</td>
<td>2834</td>
<td>Cross-sectional survey</td>
<td>General job stress</td>
<td>Suicide ideation</td>
<td>Sig+general job stress</td>
</tr>
<tr>
<td>Takusari et al, 2011, Japan</td>
<td>General population</td>
<td>3213</td>
<td>Cross-sectional survey</td>
<td>Working hours/shift work</td>
<td>Suicide ideation</td>
<td>Sig+job insecurity (males and females)</td>
</tr>
<tr>
<td>Tsutsumi et al, 2007, Japan</td>
<td>Medical school cohort</td>
<td>3125</td>
<td>Cohort</td>
<td>Job control</td>
<td>Suicide death</td>
<td>Sig+low job control</td>
</tr>
<tr>
<td>Tyssen et al, 2001, Norway</td>
<td>Medical students</td>
<td>371</td>
<td>Cohort</td>
<td>General job stress</td>
<td>Suicide ideation</td>
<td>Sig+general job stress</td>
</tr>
<tr>
<td>Wall et al, 2014, Sweden</td>
<td>Doctors</td>
<td>272</td>
<td>Cross-sectional survey</td>
<td>Colleague/supervisor support</td>
<td>Suicide ideation</td>
<td>Sig+low supervisor support</td>
</tr>
<tr>
<td>Yoon et al, 2016, Korea</td>
<td>Service and sales workers</td>
<td>1995</td>
<td>Cross-sectional survey</td>
<td>Job demands</td>
<td>Suicide ideation</td>
<td>Sig+low control</td>
</tr>
</tbody>
</table>

NS, non-significant; sig +, significant and positive relationship (eg, job stressor associated with increase in suicidality); sig −, significant and negative relationship (eg, job stressor associated with decrease in suicidality).
more generally) in low-income and middle-income countries, especially given the changing nature of work in these areas in the face of globalisation.45

Though our primary interest was in job stressor exposures as suicide risk factors, some studies only included measures of job-related stress or distress. These were included for completeness, though should be distinguished from job stressors as generally more proximal to mental health and suicidality outcomes,12 as reflected in results by the relatively high summary ORs compared with specific job stressors. The other limitations of our review were connected to its methodology and the methodology of the studies we included. As the majority of the studies in this review were cross-sectional, self-reported exposures and outcomes (eg, suicide ideation and attempts) dominated. We

Figure 2  Psychosocial job stressors and suicide ideation, males, female and all persons.
found that cross-sectional studies were more likely to identify an association between job stressors and suicidality outcomes than prospective studies. There is therefore the potential for common method variance and inflated associations and for reverse causality (as it is impossible to identify whether the exposure to job stressors occurred before suicidality). There is also the possibility of health selection in those studies that reported suicide mortality, whereby those people who were more vulnerable to suicide were also more likely to be employed in, or to report, poor psychosocial working conditions.

A number of analyses resulted in quite a high $I^2$, which suggests there was substantial heterogeneity between studies. This may be driven by the diversity of sample types, countries, exposure measures (and how these exposures were measured) and outcome measures we included. It is also important to highlight the potential for publication bias, as most studies suggested that there was an adverse effect of psychosocial job stressors on suicide outcomes. We would acknowledge that we did not control for socioeconomic factors in the meta-analysis. It is possible that socioeconomic status to some extent confounds relationships between some stressors and suicidality (eg, low job control patterns by occupational skill level and socioeconomic status). Notwithstanding these considerations, our review has a number of strengths, including the large number of studies we were able to include, large sample size and the thorough methodology we used.

We noted some evidence of gender differences in the relationships between job stressors and suicide. For suicide, the available data suggest that males exposed to job stressors are at much greater risk than females. This would align with research evidence on suicide among males more generally, which has consistently shown that males are particularly vulnerable to external social and economic stressors. Although, we would note that these are not the same as job stressors. Associations might also differ across occupational groups and country. For example, females in Japan exposed to job stressors were at elevated risk of suicide ideation. There was also some evidence of an elevated risk of suicide ideation among medical doctors, nurses and people employed in male-dominated manual labour occupations. However, the possibility that the relationship between jobs stressors and suicide is modified by occupation, country context and gender must be considered as

### Figure 3

Psychosocial job stressors and suicide death, males, female and all persons.

<table>
<thead>
<tr>
<th>Name and year</th>
<th>OR (95% CI)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colleague/ supervisor support</td>
<td>1.05 (0.83, 1.33)</td>
<td>51.53</td>
</tr>
<tr>
<td>Ostry 2007 Canada - male sawmill workers</td>
<td>1.16 (0.98, 1.38)</td>
<td>32.47</td>
</tr>
<tr>
<td>Schnieder 2011 Germany</td>
<td>0.91 (0.90, 0.92)</td>
<td>28.63</td>
</tr>
<tr>
<td>Subset total</td>
<td>0.91 (0.90, 0.92)</td>
<td>28.63</td>
</tr>
<tr>
<td>Demand</td>
<td>0.81 (0.72, 0.92)</td>
<td>24.30</td>
</tr>
<tr>
<td>Milner b 2016 Australia - females</td>
<td>0.81 (0.72, 0.92)</td>
<td>24.30</td>
</tr>
<tr>
<td>Milner b 2016 Australia - males</td>
<td>0.81 (0.72, 0.92)</td>
<td>24.30</td>
</tr>
<tr>
<td>Ostry 2007 Canada - male sawmill workers</td>
<td>1.32 (1.17, 1.48)</td>
<td>25.24</td>
</tr>
<tr>
<td>Schnieder 2011 Germany</td>
<td>1.00 (0.92, 1.22)</td>
<td>22.07</td>
</tr>
<tr>
<td>Subset total</td>
<td>1.00 (0.92, 1.22)</td>
<td>22.07</td>
</tr>
<tr>
<td>Work insecurity</td>
<td>0.89 (0.50, 1.96)</td>
<td>100.00</td>
</tr>
<tr>
<td>Law 2014 Hong Kong</td>
<td>0.89 (0.50, 1.96)</td>
<td>100.00</td>
</tr>
<tr>
<td>Subset total</td>
<td>0.89 (0.50, 1.96)</td>
<td>100.00</td>
</tr>
<tr>
<td>Job strain</td>
<td>0.92 (0.38, 2.23)</td>
<td>100.00</td>
</tr>
<tr>
<td>Baumard 2014 Germany</td>
<td>0.92 (0.38, 2.23)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**NOTE:** Weights are from random effects analysis.
hypothesized at this stage, given that not all studies produced stratified results.

The pathways through which job stressors result in higher suicidality is likely to be related to increased psychological distress and worsening mental health. There is a known association between mental health problems and suicide.47 There is also research showing that job stressor exposure and other adverse experiences at work are independent risk factors for mental ill health.5-8

Hence, it is possible that psychosocial job stressors are causes of mental health problems, which in turn are a cause of suicide and related outcomes. It is also possible that changes in psychosocial job stressors are related to adverse changes in other areas of life, such as financial or relationship change, both of which have been associated with an increased risk of suicide.48 49 Problems at work are likely to interact with these factors, heightening the risk of suicide. Beyond this, there are plausible biological pathways linking job stress to health through allostasic load and the hippocampus (memory), amygdala (fear and anxiety) and prefrontal cortex (decision making, impulse and mood control) in the brain. 50

Regardless of the pathways through which it occurs, it is clear that job stressors are associated with increased risk of suicide. Thus, job stress prevention and control should be a key component of workplace as well as some other suicide prevention strategies. 5 1 1 Furthermore, as poor psychosocial working conditions are highly prevalent, addressing these could have large population impacts in terms of reductions in suicidality. Indeed, a past study demonstrates the high population-attributable risk relating impacts in terms of reductions in suicidality. Indeed, a past study demonstrates the high population-attributable risk associated with socioeconomic factors for suicide comparative to mental illness. At the same time, it is clear that much more research is needed to unpack the complexity of the relationships between psychosocial job stressors and suicidality, particularly in regards to differences by country context, gender and occupation.

Correction notice This article has been corrected since it published Online First. The conclusions paragraph in the abstract, figures 2 and 3, and OR and CI results have all been corrected.

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