Work-related suicide: Evolving understandings of etiology & intervention

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Please cite this article as below:

LaMontagne, A. D., Åberg, M., Blomqvist, S., Glozier, N., Greiner, B. A., Gullestrup, J., Harvey, S. B., Kyron, M. J., Madsen, I. E. H., Hanson, L. M., Maheen, H., Mustard, C., Niedhammer, I., Rugulies, R., Smith, P. M., Taouk, Y., Waters, S., Witt, K., & King, T. L. (2024). Work-related suicide: Evolving understandings of etiology & intervention. *American Journal of Industrial Medicine*. https://doi.org/10.1002/ajim.23624

Work-related suicide: Evolving understandings of etiology & intervention

For submission to *Am J Industr Med* as a Long Form Commentary

ABSTRACT (unstructured, 250 words max)

Previously published analyses of suicide case investigations suggest that work or working conditions contribute to 10-13% of suicide deaths. Yet, the way in which work may increase suicide risk is a relatively under-developed area of epidemiologic research. In this Commentary, we propose a definition of work-related suicide from an occupational health and safety perspective, and review the case investigation-based and epidemiologic evidence on work-related causes of suicide. We identified six broad categories of potential work-related causes of suicide, which are: (1) workplace chemical, physical, and psychosocial exposures; (2) exposure to trauma on the job; (3) access to means of suicide through work; (4) exposure to high stigma work environments; (5) exposure to normative environments promoting extreme orientation to work; and (6) adverse experiences arising from work-related injury or illness. We summarise current evidence in a schema of potential work-related causes that can also be applied in workplace risk assessment and suicide case investigations.

There are numerous implications of these findings for policy and practice. Various principle- and evidence-based workplace suicide prevention intervention strategies exist, some of which have been shown to improve suicide prevention literacy, reduce stigma, enhance helping behaviours, and in some instances maybe even reduce suicide rates. Prevailing practice in workplace suicide prevention, however, overly emphasises individual- and illness-directed interventions, with little attention directed to addressing the working conditions that may increase suicide risk. We conclude that a stronger emphasis on improving working conditions will be required for workplace suicide prevention to reach its full preventive potential.

(249 words/250 max)

Key words (5-10): suicide; suicidal behaviours; self-harm; work; work-related; working conditions; occupational; exposures; hazards; work environment

I. INTRODUCTION & APPROACH

Suicide is a leading cause of death worldwide, and suicide and suicidal behaviour are major contributors to the global burden of disease; with the impacts extending widely and beyond decedents to those bereaved or otherwise affected by suicidal behaviour.[1-3] In absolute terms, the majority of suicide deaths occur among people of working age.[2,4] Yet the role of work and how it might contribute to suicide risk is a relatively under-developed area of research. Given that roughly two-thirds of the working age population is engaged in work, an occupational health & safety (OH&S) perspective aims to elucidate the role that working conditions play in increasing or decreasing the risk of suicide*, so as to inform workplace prevention and control strategies.*.

Defining work-related suicide, on the face of it, is quite simple: death by suicide that is wholly or partly caused by work or working conditions. . We define our threshold for determining work-relatedness as adequate evidence to justify policy or practice action, an approach informed by the precautionary principle.[5,6] The precautionary principle in public health aims to balance uncertainty of evidence with legal and ethical duties to act to prevent harm. We recognise that inferred causes based largely on observational evidence are always provisional and may change over time, and that causal inference is context-dependent. This uncertainty must be weighed against considerations including the gravity of the potentially preventable outcome and what would be required to reduce the risk in question. These considerations are revisited in the Discussion section, following the presentation of our arguments.[5-7]

Defining work in the context of work-related suicide, however, is in some ways challenging. We propose an inclusive definition of work, as set out in the next paragraph, setting aside

unemployment as a distinct and previously established suicide risk factor.[8-11] We acknowledge this as a simplification because working conditions and unemployment are not necessarily mutually exclusive contributors to suicide risk. Indeed, job insecurity, underemployment, and unemployment can be conceptualised as being on the same continuum,[12] and evidence detailed below suggests that job insecurity, as well as unemployment, increases the risk of suicide.

When evaluating work-related suicide, the main group to consider is that of persons working for profit or pay at the time of death (e.g., employees, temporary workers, contractors, and self-employed workers), and their work and working conditions as potential contributors to suicide risk. Consideration of work-related suicides should not be restricted to those happening at the workplace or during the working hours of the deceased, and all means of taking one's own life should be considered. Persons who die by suicide but were not currently working due to work-related injury or illness should also be included, whether they are out of work temporarily (e.g., on Workers' Compensation) or on permanent disability, as detailed further below. Unpaid volunteers are also entitled to safe and healthy working conditions, and are thus another included group. Finally, because the adverse effects of some working conditions can be delayed, it is also possible that former work or working conditions could contribute to suicide deaths whether among persons working in subsequent jobs, unemployed ,or no longer in the labour force. These groups are outlined in Figure 1, and discussed in further detail in the pages that follow.

We seek to integrate two approaches to identifying work-related suicides in order to gauge the magnitude of the problem: where work-relatedness is established 1) on an individual case-basis, and 2) using a population-based epidemiologic approach. We argue that these two approaches are complementary, and both are required to understand the scale of the problem and to formulate

optimal policy and practice responses (sections II and III). Following an outline of our approach, we present an integrated summary of work-related risk factors for suicide that also highlights recommended areas for consideration in workplace risk assessment and suicide investigations (section IV). Finally, we outline the strengths and limitations of this review and its implications for policy & practice in section V. The overarching aim is to provide a high-level summary of current evidence on aetiology and intervention so as to inform evolving policy & practice.

We note some acknowledgements and provisos for this Commentary: 1) a previously-published Discussion Paper authored by ADL and TK[13] provided the basis of this *Commentary*, which was subsequently expanded and refined in collaboration with 17 additional international researchers in this area; 2) we have conducted a narrative synthesis and interpretation of the literature drawing on the collective expertise of the authors; 3) we acknowledge a number of recent reviews on work and suicide which have informed this *Commentary* [14-17]; and 4) this *Commentary* was informed by, and will be complemented by, a planned systematic review & meta-analysis of working conditions and suicide led by one of the authors of this *Commentary*.[18]

II. CASE-BASED APPROACHES TO DETERMINE WORK-RELATEDNESS

Deaths by suicide are routinely investigated and documented by police, healthcare personnel, and coronial authorities. Depending upon the jurisdiction, medical examiners, coroners or police may make the final determination of a death as occurring through intentional self-harm,[3] often generating extensive documentation which can be investigated for contributing causes. Work-relatedness can be suggested by many factors such as attribution to work by the deceased (e.g., in

a suicide note) or by family, friends or co-workers of the deceased; a work location of the death; suicide being a consequence of a work-related injury or illness; or accessing means of suicide at or through work. Based on case records, various categories of work-relatedness have been proposed.

Work-related suicide has long been recognised in Japan, usually in relation to excessive working hours or job stress. Suicide due to overwork or job stress is termed *karo-jisatsu,* as distinct from sudden death from overwork, termed *karoshi*.[19-21] A Japanese National Police Report (National Police Agency, Government of Japan, cited in Yamauchi et at, 2017[22]) stated that there were 24,025 deaths by suicide in Japan in 2015. The reasons for suicide were determined by police in 75% of those deaths, and 12% of those involved "work-related issues."

In France, a set of criteria for potential work-related suicides was proposed and tested by the National Public Health agency for population surveillance purposes.[23] Each suicide or death of undetermined cause was considered 'potentially' work-related when at least one of the following circumstances was present:

- The suicide occurred in the workplace;
- A suicide note or the testimony of relatives or other close contacts implicated working conditions;
- The deceased was wearing work clothes;
- Work-related difficulties were otherwise identified in investigations.

When tested in a feasibility study of 1,135 suicide deaths in 2018, 10% were deemed potentially work-related.[23]

In Australia, a 2012 study reviewed 642 suicides identified as 'broadly work-related' based on investigations conducted by police or coroners' reports in one state over a 7-year period.[24] These suicides accounted for 17% of all suicides during that time (642/3775). 'Work-relatedness,' as defined in this 2012 study, was further classified as involving reports of 'work stressors' (55%); jumped, laid, or moved in front of a moving train or heavy vehicle (32%); involved a work location (7%); or involved work as a means (6%). Importantly however, this classification captured many people who died by suicide who were unemployed or not in the labour force (NILF) (e.g., retired, full-time students). Conservatively excluding those who were unemployed or NILF at the time of death (which may have been influenced by previous work experiences) leaves 396/3775, or 10.5% where work was a potentially contributing factor.

A 2021 analysis of 89,389 suicides across 35 states in the US between 2013-2017 used death certificates and investigation documentation, and found that 13.5% of suicides were work-related.[25] In a further analysis, these investigators estimated work was a 'major factor' in one quarter of 'work-related' suicides, or rough 3% of all suicides.[26]

A recent New Zealand study of 1678 suicide cases over a four-year period[27] determined work-related suicide as meeting either of two criteria:

- Work-related stressors played a significant role in the person's suicidality, and/or
- The means of suicide were distinctly related to the deceased person's work.

"Stressors" in this context referred to any form of adverse exposure arising from work, including workplace injuries. They found that 11.7% of suicides were work-related. Of work-related cases, most involved stressors related to work (86%), 21.8% involved work-related means, 19.3% were not employed at the time of death, and 10.2% occurred in the deceased person's workplace and met

one of the two criteria above (only half of the cases occurring in the deceased's workplace were deemed to be work-related).

To summarise, there is no single definition of work-relatedness in the above-reviewed psychological autopsy and other studies. Various indicators or categories of work-relatedness have been applied, some of which have face validity indicating work as a contributing cause (e.g., work-related difficulties) and some of which may not (e.g., wearing work clothes at the time of death). Some determined potential work-relatedness, and others were more definitive Further, following our definition, we exclude (as work-related) the use of the work or workplace *of others* as a means of taking one's own life (e.g., suicide on rail infrastructure by members of the public) if the deceased was neither working for profit or pay at the time of death nor otherwise eligible for inclusion as 'working' per Figure 1.

Case-based approaches have advanced our understanding of work and suicide, as well as justification for developing prevention and control responses both in the workplace (e.g., the 2014 Japanese National Prevention Strategy for Overwork-related Disorders[22]) and in general community settings (e.g., restricting pesticide access[28]). Case-based approaches, however, are limited by the lack of standardised data-collection methods on work-relatedness, the limited knowledge of the work circumstances of the deceased in post-mortem interviews, potential biases of persons close to the deceased, and potential biases of investigators and coroners (e.g., prioritising medical diagnoses while understating psychosocial factors when explaining suicides[29]). For example, an Australian study found that between 1985 and 2007 there were 21 workers' compensation claims for suicide in the state of Victoria, yet review of the coronial records identified work factors or a previous work injury for only 9 of the 21 workers compensation cases.[30] Accordingly, it seems likely

that work-relatedness is under-identified in studies relying on investigations of individual suicide cases, at least historically. In the section that follows, we argue that the individual case perspective needs to be complemented by a population or epidemiologic perspective.

III. EPIDEMIOLOGIC APPROACHES TO DETERMINING WORK-RELATEDNESS

In this section, we focus on epidemiologic studies that assess suicide outcomes in relation to specific occupational exposures that may be risk (or protective) factors for suicide. We acknowledge that work and suicide epidemiology has been dominated historically by studies of suicide by occupation.[31-34] While studies of occupations and suicidal behaviours may *suggest* specific workplace exposures or risk factors, they are considered here only where they complement studies of associations assessing specific working conditions or exposures. For example, some studies have found high rates of suicide in construction workers, but this is most likely explained by a combination of compositional factors (e.g., predominantly male workforce) and contextual working conditions (e.g., long working hours, job insecurity, masculine norms discouraging help-seeking).[35] Such studies of occupations or sectors are valuable for hypothesis generation and to identify target groups for general suicide prevention intervention,[36] but less informative for assessing specific risk factors or causes.

Potential work-related contributors to suicide identified by epidemiologic studies can be grouped into the following categories: chemical exposures; physical exposures; psychosocial working conditions; long working hours; precarious employment; exposure to suicide, other deaths or trauma on the job; and adverse experiences arising from work-related injury or illness.

Chemical Exposures

Unintentional occupational-related exposure to pesticides, solvents and other neurobehaviorally active agents have been associated with excesses of suicide in some studies.[37-41] As far back as the mid-1800s, case reports in rubber and rayon manufacturing documented that occupational exposure to carbon disulphide was associated with increased rates of depression, acute mania, suicide attempts and "commitments to mental institutions" among the exposed[42] (Hamilton 1943, cited in Mancuso 1972[43]). Decades later, a US retrospective cohort study of rayon workers exposed from 1938-1948, with follow-up until 1968, found up to 4-fold elevated suicide mortality rates compared to the US working age population.[43]

Some chemical exposures have plausible links to suicide through their association with increased risks of depression and anxiety symptoms, such as certain pesticide, organic solvent, and toxic metal exposures.[31,44] The association is further supported by elevated suicide rates in occupations with these exposures, such as farmers and other agricultural workers (independent of using pesticides as a means of suicide)[45] and automotive workers with potential solvent exposures.[44] However, a systematic review of occupational pesticide exposure, depression and suicide found mixed evidence of associations, with the studies limited by poor exposure data, limited control for confounding and a dearth of prospective studies.[46] One study of inorganic lead exposed workers in Korea found an association between high blood lead levels and suicide mortality among males, which the authors speculated could be mediated by lead-associated depression.[40] Finally, a study of US nuclear weapons production workers found an association between uranium exposure and suicide mortality.[41]

In summary, while there is some evidence of suicide in association with occupational chemical exposures, the evidence is patchy and for more extensively studied exposures, such as pesticides, inconclusive. Nevertheless, such exposures warrant further research. While many of these exposures are not widely prevalent in high-income countries, and exposure levels are generally lower now than historical levels, they may be of greater concern in lower and middle income countries (LMIC) to the extent that exposures persist or have increased in prevalence or intensity due to the export of hazardous industries from high-income countries to reduce production costs or escape regulation (e.g., for carbon disulphide).[47]

Physical exposures

Occupational exposures to adverse physical conditions at work, including noise and electromagnetic fields (EMF) have been investigated as potential contributors to suicide risk. It has been hypothesised that noise exposure at work may interfere with tasks or other work activities, in turn eliciting negative changes in emotions, psychological effects, and behavioural changes.[48] Some research suggests that psychosocial working conditions (e.g., job demands) interact with acoustics and noise exposure in their association with job-related stress.[48] A cross-sectional Korean national population survey (N = 10,020), for example, found that occupational noise annoyance, as a proxy for noise exposure, was significantly related to depressive symptoms and suicidal ideation after controlling for individual and socio-demographic characteristics.[49] There has been little study in this area to date, but occupational noise exposure is common in the working population and thus warrants further research.

There is mixed evidence of an association between occupational exposure to EMF and suicide. A job-exposure matrix (JEM)-based study of 21,744 electrical utility workers in Quebec found no

statistically significant association with suicide, [50] nor did an occupational title-based study of Swedish electricians.[51] Conversely, a nested case-control study of suicide mortality in a parent cohort of 138,905 male electric utility workers found an association between increasing years of employment as an electrician or line worker and risk of suicide, including a dose-response gradient.[52] This study, however, did not control for important potential confounders such as drug use and mental illness. Although the evidence is inconclusive at present, the role of noise and EMF exposures warrant further research.

Concussion (traumatic brain injury), repeated concussion, and chronic traumatic encephalopathy have been associated with a two-fold elevation in risk of suicide. [53,54] While this could be a risk for professional athletes in contact sports (e.g., football, gridiron, hockey), investigations to date have shown no excess risk of suicide among professional athletes.[55] Further research is warranted.

Psychosocial working conditions

Ove the last decade, there has been substantial growth in the number of epidemiologic studies on psychosocial working conditions as risk factors for suicide as well as continuing improvements in methodological quality.[56,57]

The first systematic review of the area[58] presented a synthesis of 22 studies assessing the relationship between psychosocial working conditions and suicide ideation, attempts, and deaths. Results suggested that exposure to psychosocial working conditions was associated with elevated risks of suicidal ideation and death.[58] Various psychosocial working conditions were associated with suicidal ideation, but only low job control was associated with increased risk of suicide mortality. The review, however, also acknowledged that studies were available on only a few

commonly measured psychosocial working conditions, and most studies were cross-sectional in design. Most studies of ideation were limited by potential dependent misclassification (common method bias) due to the use of self-reported exposure and outcomes measures. All studies were also potentially affected by confounding through health selection: workers who are more vulnerable to suicidal thoughts or behaviours may also be more likely to be employed in jobs with worse working conditions, more likely to report poor psychosocial working conditions, or both. Overall, results suggested the potential for publication bias, and high heterogeneity. Further, there was little control for socio-economic status or non-work related stressors, some summary estimates were small and marginally statistically significant, and only six studies included suicide deaths.

We have identified several additional studies on psychosocial working conditions and suicide that have been published since the 2018 review.[58] These studies found elevated risks of suicide deaths in association with low social support,[59] low job control,[59-61] job strain, [59-62] isotrain (job strain combined with low social support),[59] passive jobs [59-62] job insecurity,[63] workplace sexual harassment,[64] workplace bullying,[65] and workplace violence.[66] Some studies found evidence of a protective association for active jobs (high control combined with high demands),[60-62] however, study results were difficult to compare due to varying reference categories.[59] Some studies also found protective associations for high job demands, and no significant elevation of risk for job strain after multiple confounder adjustments.[62] The most recent study of bullying[66] presented a small meta-analysis including the earlier positive study,[65] and identified an elevated risk that was attenuated with confidence intervals including unity after adjustment for baseline mental health problems.

Collectively, these studies address most of the shortcomings noted in the 2018 review[58] and strengthen causal inference regarding the associations between psychosocial working conditions and suicide. Most were working population-based, all used register-based outcomes and prospective designs. Some used individual and some JEM-based exposure measures, with one study assessing 5-year JEM-based exposure trajectories.[62] All studies either adjusted for, or excluded, those with a history of mental illness or previous suicide attempt, and included adjustments or sensitivity analyses addressing a range of other potential confounders.

Some of these studies estimated population attributable fractions (PAF), which assume the observed associations are causal and free of residual confounding. Acknowledging these assumptions, in France an estimated 5.3% of suicide deaths among men and 9.1% among women were attributable to job strain.[59] In Sweden, an estimated 6% of suicide deaths were attributable to sexual harassment at work.[64] In the Swedish job insecurity study (13% prevalence), the PAF for suicide deaths attributable to job insecurity was calculated at 6%.[63] Many psychosocial working conditions co-occur,[67,68] thus, under the assumption that the associations underpinning these estimates are causal, the PAFs could be less than additive but will likely be higher than the maximum PAF for one given exposure.[69] We are not aware of any suicide mortality estimates that take these co-exposures into account, nor the extent to which exposures to chronic psychosocial working conditions are represented in the case record-based determinations of work-relatedness outlined in the previous section. Because case-based investigations would likely emphasise acute stressors or recent events, it is likely that a full accounting of work-related suicide that incorporates a range of common psychosocial working conditions could lead to estimates that exceed the case record-based estimates of 10-13% of suicides in the working population. Whether in the range of

10-13% or higher, this would represent a substantial and preventable work-related suicide mortality burden.

Long Working Hours

Some studies suggest that long working hours increase suicide risk. A Korean study (n = 14,484) showed 3-4 times elevated suicide mortality risk among workers working 45-52 hours and >52 hours per week compared to a reference of 35-44 hours/week, but this study was limited by the small number of suicide deaths (n = 27).[70] In a small study of US workers (n = 578), working >40 hours/week predicted a four-fold increase in odds of moderate to severe suicidal ideation compared to those working <=40 hours/week.[71] Some older studies (before 2018) also show adjusted associations between long working hours and suicidal ideation,[72] however further research is needed in this area.

Precarious employment

Precarious employment is defined in various ways,[73] which makes comparisons between studies difficult. Precarious employment also overlaps to some extent in concept with job insecurity (discussed above). In a very large register-based working population study in Sweden (n = 2,743,764), employment trajectories were characterised with regard to insecurity, income inadequacy, and lack of rights and protections; workers experiencing constant precarious employment showed a 1.2-fold elevated risk of intentional self-harm. [74] A South Korean cohort study of 3,793 workers who were permanently employed for at least 3 years reported 2 to 4-fold elevated odds of suicidal ideation when transitioning to precarious employment.[75] A similar, though smaller magnitude, finding was made in a larger nationally representative cohort of South Korean workers (n = 25,862) wherein workers transitioning from permanent to precarious jobs

reported a 1.7 times higher odds of reporting suicidal ideation (OR 1.7, 95% CI 1.3-2.3) than those remaining in permanent employment.[76] Further research is urgently needed in this area in light of the growth of precarious employment in many parts of the world.

Exposure to suicide, other deaths, or trauma on the job

Occupational exposure to trauma entails witnessing bodily injury or death, including suicide, in the course of one's work. Such exposures commonly occur among emergency responders, members of the military, social workers, mental healthcare providers, and others. A scoping review of 25 studies found that between 32 and 95% of first responders and mental health professionals had been exposed to suicide on the job.[77] Exposure to trauma is strongly associated with post-traumatic stress disorder (PTSD) which, in turn, is a risk factor for suicidal ideation and behaviours.[15]

A US survey of 1,048 first responders, crisis workers, and mental health professionals found that increasing exposure to suicide on the job was associated with increasing levels of depression, anxiety, and PTSD.[78] In an Australian national cross-sectional survey of 14,868 police and emergency responders the career period prevalence of exposure to traumatic events at work was 51%;[79] further, exposure to stressful events was associated with a 4.5-fold increase in odds of post - traumatic stress (PTS) symptoms (a proxy measure meeting core symptom diagnostic criteria for PTSD).[79] These results yield a PAF of 65% of PTS symptoms being attributable to workplace trauma exposure.[79] A further analysis of the same data showed PTS symptoms were associated both with suicidal ideation and planning a suicide attempt.[80]

Despite the high prevalence of trauma exposure, PTSD and other mental health problems amongst emergency service workers, a recent examination of more than 13,000 suicide deaths in Australia found there was no evidence of an increased risk of suicide amongst emergency service workers compared to other occupations once the age and gender of the workforce was taken into account, though there was some evidence of excess risk among ambulance personnel in particular.[81] Amongst military veterans, the results regarding risk of suicide are more mixed, with a consistent finding of increased risk of death by suicide for those in some, but not all countries.[82]

Exposure to trauma may also directly affect suicidality, independent of PTSD.[83] For example, Joiner's interpersonal theory of suicide proposes three key mechanisms to explain suicidality: thwarted belongingness, perceived burdensomeness, and acquired capability.[84] Acquired capability refers to the capability to make a potentially lethal suicide attempt; this capability can be acquired gradually through repeated exposure to pain, fear, trauma, and death—including on the job, thus potentially desensitising those exposed and reducing barriers to using potentially lethal force on the self.

Adverse experiences arising from work-related injury or illness

There is growing evidence that workplace injury and associated disability is associated with elevated rates of suicide.[85] A linked registry-based study of over 700,000 workers in Korea identified that both male and female injured workers had higher suicide mortality relative to the economically active population.[86] In the US, a study drawing on linked compensation data from one state found that work injuries necessitating more than seven days off work ,or with permanent disability benefits, were associated with almost two-fold elevated risk of suicide mortality compared to those with injuries only receiving compensation for medical expenses.[87]

The pathways underpinning these associations are complex.[88] Workplace injuries are associated with a range of adverse outcomes for injured workers, with the consequences of workplace injury not limited to the injury itself, but extending across multiple domains. Compared to non-occupational injuries, occupational injuries are more strongly associated with depressive symptoms,[89] with depression being a known risk factor for suicide. In some cases, workplace injury can cause disability (short term or long term), which may reduce income substantially, as well as acute and chronic pain, both well-known risks for suicide.[90] Pain medication including opioids are commonly prescribed and drug-related mortality and suicide is known to be higher among "lost time" injured workers compared to "medical-only" injured workers.[87] In a related vein, a US study grouping segments of the labour force by occupational injury rates found that rising injury rates were associated with rising suicide rates, opioid-related deaths, and deaths from alcoholic liver disease and cirrhosis (so-called 'deaths of despair').[91]

Worker's compensation processes may also contribute to distress and suicidality among injured workers. In Australia, elevated rates of hospital admission for self-harm have been observed among workers' compensation claimants.[92] Other research from Australia has highlighted the stress of workplace injury compensation systems for injured workers,[93] and Canadian work supports this, identifying that the compensation process contributed to the stress to a greater extent than the injury itself.[94] A more recent study of Australian police and emergency services workers found that 8% of employees making a claim reported a positive experience, contrasted with 70% who reported a poor experience; further two-thirds of those who made a claim reported that the process was unsupportive and stressful, and over half reported that it had an overall negative impact on their recovery.[95]

In summary, there is some, albeit limited, evidence that injured workers are at an increased risk for suicide. Further, evidence suggests multiple pathways through which work-related injury or illness could increase suicide risk, clearly warranting further research but also potentially providing numerous points of intervention to reduce suicide risks.

IV. PROPOSED SCHEMA OF POTENTIAL WORK-RELATED CAUSES OF SUICIDE

Based on the evidence synthesised above, we have developed a schematic summary of potential work-related causes of suicide, integrating the case-based and epidemiologic evidence summarised above (Figure 1). The schema also can serve as a framework for workplace risk assessment and management, as well as for investigating the potential work-relatedness of a suicide case.

Box A-D: Establishing the potential for work to contribute to a suicide

There are numerous forms of 'work' that could contribute to suicide risk. These include those who work for profit or pay or as a volunteer at the time of death (Box B). In Australia, for example, there are large volunteer workforces with potential for exposures to trauma and many of the other hazards named above in firefighting (144,000), emergency services (43,000), and surf lifesaving (190,000) alone, equating to ~3% of the working population. Among persons who were not working at the time of death *due to a work-related injury or illness* (Box D), it remains possible that their death was related to paid or volunteer work as detailed above. Finally, working conditions in past jobs may contribute to suicide risk among those working currently, or who were not working at the time of death, or who were out of the workforce on temporary disability or unemployment

(Box C). With regard to investigation of suicide deaths, these various forms of work could effectively be discerned by documenting an employment history over the years preceding death from next-of-kin or other key informants.

Boxes E-G, described in further detail below, outline potential work-related causes. Neither the time nor place of a suicide (i.e., during working hours, or whether at work or not) are criteria for assessing work-relatedness, hence precluding their representation in this schema.

Box E: Access to means

Access to means of suicide through one's work or workplace is a well-established risk factor for suicide.[14,96,97] Examples include police, military, and other protective services personnel with access to firearms[98] agricultural workers with access to pesticides, veterinarians with access to euthanising drugs,[99] and healthcare professionals with access to medicines.[100,101] Also supporting this association, an Australian national study showed that workers with access to means are more likely to use these means to end their lives than those without access to means.[97] An earlier national study from New Zealand made similar findings.[102]

It should be noted that the use of work-related means might or might not be precipitated by work-related factors. In some, but not all, contexts, work-related means and other work-related risk factors co-occur, such as among trauma-exposed emergency responders with access to firearms or medicines, and veterinarians accustomed to relieving suffering with euthanising drugs and access to such drugs. Whether combined with other work-related risk factors or not, control of access to work-related means warrants careful attention in workplace risk assessment and suicide prevention.

Box F1: Exposure to adverse chemical, physical, or psychosocial and other working conditions

As summarised above, current evidence suggests that unintentional occupational exposures to chemical or physical hazards are not major contributors to suicide risk, but this warrants monitoring in the future. The evidence on psychosocial working conditions is the most rapidly expanding area of work and suicide research. In our view, there is adequate evidence to presume that low job control, high job strain, job insecurity/precarious employment, sexual harassment at work, bullying, occupational violence, and long working hours could be work-related causes of suicide. Unlike other exposures such as chemical exposures for example, these are common exposures in the working population and are also associated with adverse impacts on other mental and physical health outcomes.[103-105]

Job-exposure matrices (JEMs) could be used in risk assessment and management, as well as to supplement investigations of individual suicide cases to establish typical exposure levels to hazardous chemicals,[106] physical stressors,[107] psychosocial working conditions,[108-110] and other occupational hazards[111] based on job titles and industrial sectors of the deceased. Historically, JEMs have been used mainly in research, but could be a valuable tool in these more applied contexts. Importantly however, JEMs can only be meaningfully used for work exposures that vary to a considerable extent by job group, thus, are only useful for some working conditions.[112]

Box F2: Exposure to suicide or other deaths and trauma on the job

As noted above, these exposures tend to occur mainly in particular occupations (e.g., emergency responders, mental health care providers, protective services workers). We are unaware of any JEMs that specifically cover exposure to deaths and trauma on the job, but there are actively

updated inventories of occupational exposure data, including JEMs, that could be consulted in the future (e.g., https://occupationalexposuretools.net/).

Box F3: Exposure to normative work environments with high stigma or discouragement of helping behaviours

Work environments vary substantially in prevailing normative influences. Further, the norms within a workplace can vary in the extent to which they inhibit or foster help-seeking behaviour. Here we distinguish these normative influences that operate within workplaces from both macro level normative influences (Box F4) and psychosocial working conditions (Box F1), noting that these may overlap. Mental health stigma within a workplace has been found to be related to suicidal ideation,[95] and it is speculated that perceived mental health stigma may hinder help-seeking and lead to damaging or maladaptive coping behaviours.[95] Masculine norms emphasising self-reliance and repudiating help-seeking have been associated with suicidal ideation,[113,114] and it is posited that the enforcement or internalisation of these norms within male-dominated workplaces such as in the construction industry may contribute to high rates of suicide observed in such settings.[115] Though stigma is a common barrier to help-seeking, barriers can manifest in other ways as well. For example, questions about mental illness in medical registration processes have been shown to be a barrier to help-seeking among physicians.[116]

Views may differ on whether environments with high stigma and discouragement of helping behaviours are working conditions subject to OH&S prevention and control intervention, although discriminatory behaviours are legislated against under disability and discrimination laws in many countries. Nevertheless, the evidence suggests that they are important modifiable work-related risk factors for suicide, and stigma and helping behaviours are a major focus of general workplace

suicide prevention strategy which aims to prevent suicide regardless of cause (revisited in Discussion section below).

Box F4: Exposure to broad cultural norms (macro level) that promote extreme orientation to work

Societies vary in normative orientation to work. Here, we consider what is known about the way broad societal cultural norms related to work are associated with suicide. We note some overlap with Box F1 – many of the psychosocial working conditions considered in section F1 are relevant here. The focus in this section is macro level cultural norms that drive exposure to psychosocial working conditions. Japan, with one of the highest rates of suicide in the world,[117] is used as an example, noting that such macro level conditions may operate in many contexts.[21] The Japanese term *karo-jisatsu* translates to *suicide by overwork*, and is applied to those who have suicided after a sustained period of overwork, characterised by extreme working hours and a heavy workload with little time off work.[19,20] Given that there is overlap with long working hours and psychosocial working conditions (Box F1), *karo-jisatsu* may represent an interaction between psychosocial working conditions and powerful social or cultural norms.

Typical of *karo-jisatsu* is a sense of guilt, shame and self-blame for an inability to accede to work expectations.[118] Further, in Japan, a strong emphasis is placed on collectivism, meaning that within the workplace, employees are expected to prioritise and optimise the goals and successes of the organisation over their own wellbeing.[19] The way in which these Japanese social norms, steeped in values of respect, perfectionism, and collectivism,[117] are embedded and enacted within work settings is thought to underpin *karo-jisatsu*.[20] Intersecting with and compounding work related

suicide risk in Japan is stigma regarding mental health conditions,[119] which means that those in distress may also be reluctant to seek help (see also Box F3).

Box G: Adverse experiences arising from work-related injury or illness

We recommend that suicide investigations, in addition to documenting employment status and/or work history, should collect data on whether the deceased was affected by a work-related injury or illness, whether they were working at the time, on temporary disability, unemployed or no longer in the labour force.[30] Such cases could be deemed to be work-related if the consequences of that injury or illness were a contributing cause of the suicide, e.g. through loss of income, status, disability, or pain.

V. DISCUSSION

In this Commentary, we have proposed a definition of work-related suicide from an OH&S perspective, assessed the weight of evidence for potential work-related causes of suicide, and reviewed estimates of the proportion of suicides that may be work-related. On the basis of this synthesis, we have developed a schema of potential work-related causes to summarise current evidence and provide guidance for risk assessment and case investigations of potential work-related suicides. Our arguments have a number of strengths and limitations as outlined below.

Strengths and limitations

The distinctions between being in work, being unemployed, retired, or otherwise not in the labour force (NILF) are become increasingly blurred in high-income countries, particularly with the rise of precarious and highly insecure employment, with some workers cycling frequently between paid work, unemployment, and NILF. We have attempted to be as comprehensive as possible in terms

of eligible forms of work. One of the greatest challenges is assessing potential work-relatedness due to previous jobs, regardless of current employment status. Similar challenges occur in the study of work-related contributions to chronic multi-factorial diseases such as cancers and heart disease; methods to address lagged impacts of exposures, changing occupations, and time-varying exposures, for example, have been addressed in many of the recent studies of psychosocial working conditions and suicide reviewed above. For example, a French study provided evidence of lasting effects of psychosocial working conditions on suicide risk after leaving employment (Tables S1-2 in Niedhammer et al, 2020[59]).

Suicide deaths usually involve multiple causal factors,[2,3,14] of which work-related factors may be one or more among multiple. Further, non-work risk factors are usually stronger in magnitude of association with suicide than work-related factors (e.g., past or current mental illness, history of previous suicide attempt). Mental illness, however, can be work-related, such as psychosocial working conditions as contributors to incident depression.[120] Taking a conservative approach by controlling for past or current mental illness (thus excluding potentially work-related depression as a mediator), as well as controlling for various non-work-related risk factors and confounding by health selection, associations between psychosocial working conditions and suicide persisted in the most recent large-scale register-based prospective cohort studies. In a related vein, in our definition we have not considered whether work was a major, minor, or other contributor to a given suicide. While this is a particular limitation of the individual case-based estimates of the proportion of suicides that are work-related (for all except one study[26]), the epidemiologically-based population attributable fraction estimates are less affected by this limitation. This argues for taking an integrated approach to workplace mental health and suicide prevention, wherein programs combine strategies to address both work- and non-work-related risk and protective

factors, as discussed further below.[120,121] This would include resourcing General Practitioners, psychologists, and other front-line support and mental healthcare providers with the time, knowledge, and skills to conduct occupational histories and consider the role of work in aetiology, treatment, and rehabilitation.[120]

Some previous reviews have highlighted that heterogeneity in results of psychosocial working conditions and suicide studies may be a concern.[16,58] Heterogeneity can arise through bias and/or confounding, but it can also be genuine (without bias), arising through differences in sample composition, design, methods, context, or other factors. Previous research has demonstrated effect modification of psychosocial working condition—mental health relationships by gender,[122] socio-economic position,[123] and national labour and social policies.[124] Hence, heterogeneity sometimes reveals variation that could inform policy and practice responses. The variety of designs, methods, measures, and analytical strategies brought to bear in assessing the relationship between psychosocial working conditions and suicide is also a positive: overall the evidence has yielded qualitatively consistent results, providing further support, by triangulation, for causal inference.[125]

In this *Commentary, we have focussed* on suicide risk factors, taking an OH&S perspective. We also acknowledge that work can be beneficial to health and wellbeing, and certain aspects of work may protect against suicide; these include providing income and promoting sense of purpose and belonging, time structure, meaningfulness, and more.[126] These positive or protective aspects of work also warrant attention in workplace mental health and suicide prevention interventions, as further detailed elsewhere.[120,126]

We have not extensively delved into suicide theory. Working conditions that increase the risk of depression and other psychiatric disorders have clear plausible links to suicide, as these disorders are strong risk factors for suicide.[127] But not all who die by suicide have psychiatric disorders. For examples, in certain LMIC many studies show that fewer than half of people who die by suicide have prior mental illness,[128,129] and a recent US study suggested that an estimated 19.6% of adults had no antecedent psychiatric disorder among first suicide attempts.[130] We have touched on Joiner's interpersonal theory above, noting the potential that exposure to trauma on the job could increase suicide risk through acquired capability. Working in isolation, low participation in decision-making (a dimension of job control), poor social support at work, and bullying and incivility at work, for examples, could also contribute to work-related suicide through Joiner's notion of thwarted belongingness.[84] A recent qualitative study suggested that influence at work (a key aspect of job control) was a marker of being a valued member of the workplace community, again linking psychosocial working conditions to the construct of belongingness.[131] Further, poor supervisor support or supervisor bullying or incivility could contribute to perceived burdensomeness. In short, there are plausible roles for adverse working conditions in each of Joiner's three constructs in the interpersonal theory. Access to means is a factor common to most theories or models of suicide, which has clear relevance when this is enabled through one's job. A more detailed discussion of work-related factors and suicide theories and models is provided in the 2022 UK Health & Safety Executive Expert Committee review;[16] the authors of this report outline a number of ways in which work-related factors could play roles in the integrated motivational-volitional model,[132] which has some overlap with Joiner's model. Finally, a theory of work-related suicide was proposed in 2021.[15] In short, deferring to these and other previously published reviews,[15-17] there is consistency between various theories and a role for work and working conditions as contributing causes to suicidal behaviour.

Although we did not conduct a systematic review of the evidence and we may have missed some studies, we are confident that our international and multi-disciplinary expert team of authors identified the major studies linking working conditions to suicide. A major limitation of the current evidence base is that most is based on populations in high income countries. Strikingly, 80% of suicide deaths occur in LMIC, but less than 15% of suicide research is based on LMIC populations.[3] This represents a substantial research gap that urgently needs to be addressed.

Finally, there are clearly gaps in the evidence base both in terms of aetiology and intervention. These gaps constitute further limitations and have been highlighted throughout this Commentary.

Implications for Policy & Practice

The findings of this Commentary have several implications for policy and practice.

Workplace prevention & control

To the extent that specific working conditions contribute to suicide risk, they should be managed, controlled and where 'feasible' or 'practicable', prevented in work settings. This follows the precedent and principles of OH&S intervention and regulation in high income counties.[133] The caveat of where 'feasible' (or 'practicable') acknowledges that in some circumstances, adverse exposures are unavoidable, such as exposure to trauma among emergency responders. Standard OH&S intervention principles would apply: preferencing work-directed elimination of exposures, followed by reduction of exposures, then worker-directed measures to moderate the impacts of exposures, and finally illness-directed measures to minimise the adverse impacts of illness.[134]

Psychosocial working conditions, long working hours and precarious employment are the most prevalent work-related risk factors for suicide when considering their overlap with normative work

environments and culture. They are also the best supported by current evidence and are already recognised as high priorities for prevention and control because they are established risk factors for a range of other adverse outcomes including depression, burnout, cardiovascular disease, premature mortality and more.[103-105,120] The association of these risk factors with suicide powerfully reinforces the already established need for exposure prevention and control efforts from an OH&S perspective. Further, best practice strategies are available to improve psychosocial working conditions, and prevent exposure-associated adverse impacts on health .[120 135 136 137,138] These strategies would apply equally to preventing exposure-associated suicide risk.

Prevalent practice to reduce the impacts of psychosocial working conditions on health, however, has often fallen short of best practice, with a disproportionate emphasis on worker- and illness-directed measures, and inadequate emphasis on work-directed prevention and control.[120,121,139-141] This urgently requires rebalancing.

There has been massive growth in workplace mental health programs over the last two decades, including in workplace suicide prevention. A 2015 systematic review[142] updated in 2018[14] identified 13 published examples of workplace suicide prevention programs, only five of which included some form of evaluation. Evaluated programs provided evidence of improvements in suicide awareness and literacy, attitudes towards suicide (including stigma), and helping behaviours, and one large-scale program in the US Airforce showed an implementation-associated decline in the suicide rate.[143] A separate systematic review of programs for emergency and protective services workers included a meta-analysis of five studies, showing an approximate halving of the suicide rate over an average follow-up period of 5.25 years.[144] There were few programs in which restrictions to access to means have been evaluated. In a Montreal police force program,[145] improvements were

reported in supervisor's willingness to remove an officer's service revolver as a suicide prevention measure; further, an estimated 15% of supervisors who intervened in a crisis reported removing the officer's service revolver. Such measures, however, must be balanced with the risk of potentially stigmatising the affected worker and discouraging workers in distress from seeking help. Nevertheless, this multi-component program has shown sustained reductions in suicide rates compared to non-intervention comparison departments over more than two decades of follow-up.[146]

With respect to access to means, pesticides warrant particular mention as a means to take one's own life, for people accessing them through work or otherwise. Intentional self-poisoning with pesticides accounts for approximately one in five suicides globally, pesticides are the most common suicide method used in LMIC, and the majority of suicides worldwide occur in LMIC.[3 129] Hence efforts to eliminate, reduce the use of, and restrict access to pesticides is of paramount concern for both occupational health and general population health, particularly in LMIC.[28 129] The data from trials of safe storage approaches are not as positive as anticipated but workplaces may prove a more effective setting.[147] This aligns with OH&S authorities or regulators in some jurisdictions including an extended purview to protect the public from risks arising from work or workplaces.

In summary, most workplace suicide prevention programs to date have utilised the workplace as a setting for general suicide prevention, usually without addressing working conditions. These programs contribute importantly to suicide prevention independent of cause, and could work in concert, or in parallel, with work-directed approaches to reduce adverse working conditions.[121,139] The importance of addressing working conditions has been acknowledged in policy advice as early as the 2006 WHO Guidelines for Workplace Suicide,[83] but has yet to be realised in prevalent

practice. Improving the focus on working conditions should be a priority for workplace mental health in general, and for workplace suicide prevention in particular. There are growing calls to address the upstream social, structural and other determinants of suicide[148] – addressing working conditions as one such determinant would be a positive step in this direction.

Post-incident response, or 'postvention', entails interventions following a suicide or other critical incident or traumatic fatality in order to alleviate the distress of co-workers and others who have been affected by the death, to reduce the risk of further suicides in the same group, and to promote the recovery of the affected group.[149] A 2021 rapid review identified five critical incident response programs in workplace settings.[149] Due to the small evidence base and other limitations, the review did not provide evidence of the impacts of postvention interventions on adverse outcomes for workers or organisations. While the need for such programs is clear, particularly in sectors with anticipated exposure to trauma, care is also needed to avoid repeating previous mistakes made with post-incident debriefing, where a well-meaning intervention proved to be unhelpful and possibly harmful due to the disruption of people's usual coping mechanisms.[150] Pearce et al[149] provide principles-based recommendations for postvention planning for pre-incident, incident, and post-incident aspects.

Finally, the schema of potential work-related causes (Figure 1) can be applied in the development of workplace programs, particularly at the risk assessment stage.

OH&S authority investigation & surveillance of work-related suicide attempts and deaths

Suicide attempts or deaths that occur at work should trigger immediate investigation by OH&S regulators in similar fashion to any other traumatic injury or critical incident; this is standard

practice in many high income countries.[151] When suicide attempts or deaths occurring outside of work may be work-related, investigation by OH&S regulators should also be triggered.[152] In the latter instance, suspicion of work-relatedness would need to be determined by police, coroners or other investigators, and OH&S regulators would need to be actively notified. The focus of the OH&S regulator would be on potential work-related causes of suicide (Figure 1), as suggested by findings from preceding death investigations. OH&S regulator investigations would, ideally, precede and inform final determinations of death by intentional self-harm by coroners or other authorities, and their focus on work-related hazards would complement both police and coronial investigations (e.g., could draw on JEMs to determine exposure history for some exposures). OH&S regulator investigations would also be essential to closing the workplace health surveillance loop, wherein the occurrence of work-related injury or death, should feed back to reducing exposure to the identified occupational hazards. This could occur through jurisdiction-based enforcement actions, educational campaigns, or other intervention strategies, and would not be solely restricted to the affected workplaces.[153]

Following potential work-related suicide investigations, those deemed work-related should be reported to national occupational injury or disease registries and surveillance systems to facilitate national monitoring of trends in relation to policy and practice developments, and on-going research. [152,154]

Workers' compensation

Work-related suicide is already acknowledged and eligible for workers' compensation in many jurisdictions around the world. These include France, Japan, Canada, and Australia.[22,23,30,155] Detailed discussion of the compensability of work-related suicide is beyond the scope of this review, but to the extent that work-related causes contribute to a given suicide, it would seem

appropriate that such deaths are covered by workers' compensation. Based on the evidence detailed above, workers compensation systems also require reform to decrease the potential for harm due to adversarial aspects of claims processes as a risk factor for suicide and adverse impacts on mental health.[85]

Conclusions

Work-related suicide likely represents a substantial preventable burden in the working population. We have summarised our review findings in a schema of potential work-related causes of suicide that can be applied in risk assessment and prevention programs as well as case investigations. The evidence linking psychosocial working conditions to suicide, in particular, has grown stronger in recent years. Given that these are common exposures, psychosocial working conditions could be substantial contributors to preventable work-related suicides. Multiple intervention strategies, based on both principles and evidence, are available to address this problem. Some of these strategies have been shown to improve suicide prevention literacy, reduce stigma, enhance helping behaviours, and in some instances have been associated with reduced suicide rates. Current workplace suicide prevention policy and practice, however, over-emphasises individual- and illness-directed interventions and devotes too little attention to addressing working conditions that increase suicide risk. A stronger emphasis on improving working conditions will be required in order for workplace suicide prevention to reach its full preventive potential.

(8,430 words)

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