

**Work-related causes of mental health conditions and interventions  
for their improvement in workplaces**

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## Lancet Discussion Paper Series on Work and Health, Paper #2

### Work and mental health: Discussion paper on aetiology and intervention

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## Summary

Mental health problems and disorders are common in the working population and are costly, both for individuals, employers, and society. This discussion paper provides an overview of the current state of knowledge to inform research, policy, and practice. We synthesise the available evidence, examining both the role of working conditions in the aetiology of mental disorders, and what can be done to protect and promote mental health in the workplace. We show that exposure to several working conditions is associated with onset of depressive disorders, the mental disorder studied most. The causality of the association, however, is still debated. Causal inference would be strengthened by more research with stronger linkage to theory, better exposure assessment, innovative analytic methods, and better understanding of the role of context. Regarding workplace interventions, there is growing evidence for the effectiveness of interventions to protect and promote mental health and well-being in the workplace; however, there is a disproportionate focus on worker- and illness-directed interventions relative to improving working conditions. Moreover, research is mainly conducted in high-income countries and often does not address workers of lower socioeconomic position. More flexible and innovative approaches, tailored to local circumstances, are needed in implementation research in workplace mental health to complement experimental studies. Improvements in translating workplace mental health research to policy and practice, such as through workplace-oriented, concrete 'how to' guidance for intervention, and by national policies and programmes, focussing especially on those most in need, could capitalise on the growing interest in workplace mental health, potentially yielding important mental health gains in working populations.

## Section 1: Introduction, structure and approach

Mental health problems and disorders are common in the working population.<sup>1-3</sup> This has substantial implications for individuals, employers, and society, prompting a variety of national and international policy and practice initiatives in the area, most recently the World Health Organization (WHO) 'Guidelines on mental health at work' that were published together with a joint policy brief by WHO and the International Labour Organization (ILO) in September 2022.<sup>1,2</sup>

This discussion paper – the second in a series of three on 'Work and health' – provides an overview of the current state of knowledge, recommendations and research needs to inform the continued development of workplace mental health policy and practice. We start by defining key terms and delineating why work and mental health are important concerns for research and practice (section 1). We then synthesise the available evidence, examining first, the role of working conditions in the aetiology of mental disorders (section 2), and second, what can be done to protect and promote mental health in the workplace (section 3). For section 2, we conducted an overview of systematic reviews, synthesising the vast and rapidly growing body of relevant literature. For section 3, we narratively summarised recent systematic effectiveness reviews of workplace mental health interventions alongside other emerging evidence, because the literature is too heterogeneous for a quantified overview of reviews. In both section 2 and 3 we give directions for future research and in section 3 also for policy and practice. We conclude (section 4) that the workplace offers considerable potential to influence population mental health by preventing harm, promoting the positive aspects of work, and providing support for people with mental health problems manifesting in the workplace setting, but also argue that this only can be achieved by continued activities in research, and the development of policy and practice.

## Mental health in the working population

According to WHO, mental health is “a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community”.<sup>4</sup> We distinguish three aspects of mental health; mental disorders, mental health problems, and mental well-being (**Textbox 1**). These distinctions are important because the evidence base varies substantially for the three aspects, and there are differing implications – for example, for protection, promotion, and compensation. For further elaboration see **Supplementary appendix S1** (page 2-3).

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**Textbox 1 about here**

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Based on validated measures used in psychiatric epidemiological studies, average national estimates of the prevalence of mental disorders in the working age population are about 15%.<sup>3</sup> Depressive, anxiety, and substance use disorders are the most common disorders,<sup>8</sup> and may have further increased during the COVID-19 pandemic.<sup>9</sup> Mental disorders and suicide are more common among workers of lower occupational grade,<sup>10-16</sup> suggesting that work might be an important social determinant, although life-course selection effects may also play a role. See also paper 1 on ‘Work as a social determinant of health’ of the ‘Work and health’ series.<sup>17</sup> The diagnosed prevalence of specific mental disorders differs by gender, age, ethnicity, culture, and other factors, e.g., depressive disorders are more often diagnosed in women, whereas substance use disorders are more often diagnosed in men.<sup>8</sup> It is debated whether these differences are due to true differences in prevalence or are, at least partly, explained by biases, e.g., different approaches when diagnosing disorders, or barriers to seek help in the health care system.<sup>18</sup>

## Impacts of mental health problems

The nature and severity of mental disorders, and their duration and chronicity, are important determinants of current and future disability. Workers with mental disorders are at increased risk of sickness absence, unemployment, permanent exit from employment, and lower lifetime earnings and income, which in turn may exacerbate the mental disorder, creating a vicious cycle.<sup>19-23</sup> See also paper 3 on ‘Health and inclusive labour force participation’ of the ‘Work and health’ series.<sup>24</sup> At the societal level, it is estimated that more than 1 trillion US Dollars are lost globally in productivity due to depressive and anxiety disorders each year.<sup>1,2,25</sup>

At the individual level, workers experiencing mental health problems face issues regarding job retention and unemployment, potential for discrimination, and impaired quality of life.<sup>26,27</sup> For organisations and employers, concerns include decreased productivity and organisational performance.<sup>26</sup> From a societal perspective, mental disorders are the most rapidly rising category of diagnoses leading to early exit from the workforce onto disability pension in many high-income countries.<sup>3</sup> Claims for work-related mental health problems have also become a major cost for workers compensation systems.<sup>26</sup>

Consequently, workplace mental health has become an active area of policy and practice development. For example, the 2017 UK *Thriving at Work* report, sets out what employers can do to support the mental health of employees, and details the significant costs of poor mental health to businesses and the economy as a whole.<sup>28</sup> In Australia, the National Mental Health Commission has recently launched the *National Workplace Initiative* to provide a nationally consistent approach to workplace mental health.<sup>29</sup> From the occupational health perspective, policy initiatives to codify the management of psychosocial risks at work include the 2013 *Canadian Standard*,<sup>30</sup> the 2021 International Standards Organisation’s (ISO) Guidelines,<sup>31</sup> and the recent WHO Guidelines.<sup>1,2</sup>

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**Textbox 2 about here**

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## **Section 2: The aetiological role of working conditions in the development of mental disorders**

While it is widely agreed that working conditions can impact worker well-being, both positively and negatively,<sup>26</sup> there is less certainty regarding the potential role of work in the onset of mental disorders. In this section, we assess and summarise the evidence concerning whether working conditions may increase risk of mental disorders.

Research on work and risk of mental disorders is a rather young field. In the 1960s and 1970s, work and organisational psychologists as well as stress researchers began examining effects of what was later termed ‘psychosocial work environment’<sup>32</sup> on workers’ mental health.<sup>33-36</sup> Large-scale epidemiological studies on working conditions and onset of mental disorders, however, did not appear until the end of the 20th century.<sup>37,38</sup> After the turn of the century, the proliferation of prospective studies accelerated, with most research focusing on depressive disorders.<sup>39</sup> Today, a considerable number of systematic reviews and meta-analyses have been published summarizing the literature on working conditions and risk of mental disorders.

To provide an overview of the current evidence about the association between work environment and risk of mental disorders, we conducted an overview of systematic reviews, also known as ‘umbrella review’ or ‘meta-review’.<sup>40,41</sup> Overviews of reviews were developed in response to the

rapidly increasing number of systematic reviews and meta-analyses in many research fields.<sup>42</sup> They synthesise the results of published systematic reviews and meta-analyses and can provide researchers and policy makers with a comprehensive synthesis and critical assessment of the research evidence.<sup>40,41</sup>

## **Methods for the overview of reviews**

We searched for systematic reviews with meta-analyses of prospective cohort studies published between 2017 and 2021. By limiting the search to the last five years, we assumed that results from older studies were included in the most recent reviews. The key parameters were the following PECO: **P**opulation: Working age population, worldwide; **E**xposure: Individuals exposed at work to specific physical, chemical, ergonomic, or psychosocial working conditions; **C**omparator: Individuals not exposed; **O**utcome: Onset of mental disorders, as defined in ICD-10 or DSM-5.

We assessed the quality of the included reviews with the 'Health Evidence Quality Assessment Tool' that provides an overall score differentiating between reviews of weak ( $\leq 4$  points), moderate (5-7 points), and strong (8-10 points) quality.<sup>43</sup>

We assessed the certainty of evidence by reviewing the extracted estimates and by considering different factors for increasing and decreasing our confidence in the estimates.

See **Supplementary Appendix S2** (page 4-6) for more details on the methods.



## Results from the overview of reviews

We identified 1,242 records of which seven systematic reviews with meta-analyses remained eligible.<sup>44-50</sup> See **Supplementary Appendix S3** for details on the study selection in the PRISMA flow diagram (**Figure S3-1**, page 8), key characteristics of the seven included reviews (**Table S3-1**, page 9-10), and the 24 reviews that were excluded after full-text screening (**Table S3-2**, page 11-12).

The outcome was depressive disorders in six reviews and mental disorder with a sickness absence certification in one review. Virtually all primary studies in the reviews came from high-income countries.

**Table S3-3** (page 13) in the **Supplementary appendix** shows the quality assessment of the reviews. Of the seven reviews, five were rated of strong, two of moderate, and none of weak quality.

We extracted 26 pooled estimates from the seven reviews, depicted in **Figure 1**. We categorised the estimates in four groups; 'General psychosocial work stress models', 'Working time arrangements', 'Negative acts at the workplace', and 'Other working conditions'. We did not pool the pooled estimates further because a) some of the estimates in the reviews were based on the same primary studies, and b) we judged the working conditions as too heterogeneous for pooling.

### ***General psychosocial work stress models***

This group included studies based on established psychosocial work environment exposure models; (i) the job strain model (combination of high job demands and low job control),<sup>51</sup> (ii) the effort-reward imbalance model (combination of high effort and low reward at work),<sup>52</sup> and (iii) the organisational justice model (consisting of the sub-dimensions procedural and relational justice).<sup>53</sup> These models have been developed particularly with regard to risk of cardiovascular disease. All

these exposures were associated with onset of depressive disorders, onset of sickness absence due to mental disorders, or both. The pooled estimates ranged from 1.14 (95% CI: 1.05 to 1.25) to 1.77 (95% CI: 1.47 to 2.13). The results were most robust for job strain, examined in the largest number of studies.

### ***Working time arrangements***

The pooled estimate for long working hours was 1.08 (95% CI: 0.94 to 1.24). One review also reported estimates for shift work and night work,<sup>46</sup> however, the estimates were partly based on cross-sectional studies and were therefore not included.

### ***Negative acts at the workplace***

Exposure to workplace bullying was associated with a 2.58-fold increased risk of depressive disorders, by far the strongest estimate among all working conditions in **Figure 1**. However, this estimate was based on only four studies with a wide 95% confidence interval (1.13 to 5.93) indicating low precision. The pooled estimate for workplace violence and threats indicated a 1.42-fold increased risk of depressive disorders with a narrow confidence interval (95% CI: 1.31 to 1.54).

### ***Other working conditions***

Other working conditions included mainly single components of the general psychosocial work stress models (e.g., high job demands, specific job control measures, job insecurity) plus low social support and high emotional demands. The estimates ranged from 0.93 (95% CI: 0.77 to 1.13, low decision authority) to 1.76 (95% CI: 1.49 to 2.08, low rewards at work).

## **Interpretation and discussion of the overview of reviews**

Of the 26 estimates depicted in **Figure 1**, 20 involved the outcome depressive disorders, whereas six estimates involved diagnosed mental disorders from sickness absence certificates that included but were not limited to depressive disorders. Thus, the evidence is largely restricted to depressive disorders, as there was a paucity of reviews on other mental disorders.

The vast majority of the pooled estimates (20 out of 26) indicated that exposures to adverse working conditions were associated with an increased risk of mental disorders. The magnitudes of these associations were generally small (13 estimates between 1.07 to 1.49) or moderate (six estimates between 1.53 to 1.77, these estimates were for job strain, effort-reward imbalance (in two reviews), low relational justice, low rewards, and job insecurity). Only one estimate was above 2.00 (workplace bullying, 2.58), which is regarded as the threshold for “large magnitude of effect” according to GRADE and Navigation guide.<sup>54,55</sup> However, also small to moderate estimates may entail substantial potential for prevention if the exposure is highly prevalent. Niedhammer et al. estimated that 17% to 35% percent of depressive disorders in Europe may be prevented by eliminating adverse psychosocial working conditions, because some of the exposures were highly prevalent (e.g., job strain with 26% prevalence).<sup>56</sup> This calculation is, of course, based on the assumption that the reported associations between working conditions and risk of mental disorders are causal. Below we discuss the certainty of evidence for a causal association.

### ***Certainty of the evidence***

Factors that increase confidence in the estimates:

- The quality of most reviews was high, and the reviews had thoroughly examined the risk of bias in the primary studies.

- All primary studies included in the reviews were prospective cohort studies, the gold standard design for assessing causation in epidemiology when randomised controlled trials are not feasible.
- Nearly all primary studies adjusted for the basic confounders, gender, age, and socioeconomic position, while many primary studies further adjusted for a wider range of potential confounders.
- Estimates were relatively consistent across the reviews.
- Confidence is particularly high for job strain (indications of exposure-response associations)<sup>45</sup> and workplace bullying (large pooled estimate >2.0).<sup>46</sup>

Factors that decrease confidence in the estimates are:

- With the exception of workplace bullying, all pooled estimates were smaller than 2.0, thus residual confounding remains a concern.
- The estimate of workplace bullying was strong, but was based on only four primary studies.<sup>46</sup>
- Only few primary studies used repeated measures of exposures or analysed exposure-response associations.
- Time of onset of a mental disorder may be earlier than time of diagnosis. Further, considering the fluid and episodic nature of many mental disorders, studies using interviews or rating scales to assess mental disorders may have missed mental disorders that occurred between baseline and follow-up and were in remission at follow-up assessment. Studies using healthcare register data will have missed mental disorders of individuals who did not seek help in the health care system. It is possible that these include individuals who are facing specific barriers at work for seeking mental health care, such as pressure to work also when being ill (e.g., precariously employed workers with no paid sick leave).
- The vast majority of estimates were based on self-reported working conditions raising concerns about reporting bias.

After reviewing the extracted estimates from the reviews and after considering the factors for increasing and decreasing confidence in the estimates, we conclude: There is clear evidence from prospective cohort studies that there is a statistical association between exposure to certain adverse working conditions and risk of depressive disorders (for other mental disorders, there is an insufficient number of studies) and it is unlikely that these associations are due to chance. These associations may indicate a causal effect of certain working conditions on the risk of depressive disorders; however, it cannot be ruled out that estimates are inflated or deflated due to biases.

### **Future directions for aetiological research**

To further improve the certainty of the evidence, we suggest seven areas for future research. For further details see the discussion section in **Supplementary appendix S4** (page 14-15).

**Better theoretical framework.** Research on work stress models, such as job strain, did not originate from an interest in workplace mental health but from an interest in other health outcomes, mostly cardiovascular disease.<sup>57</sup> Consequently, the conceptualizations of work stress factors are not well aligned with aetiological concepts discussed in psychiatry, that, for example consider experiences of humiliation and severe threats to self-esteem as key in the aetiology of depressive disorders.<sup>11,58</sup> There is a need for closer collaboration of scholars in occupational epidemiology and psychiatry to develop theoretical frameworks explaining the processes that could link adverse job exposures to mental health disorders, as recently also suggested for work and suicide research.<sup>59</sup> Valuable insight for better theoretical frameworks may also be gained by gathering information from workers with lived experience with mental health problems.

**Better exposure assessment strategies.** More studies are needed that are less dependent on assessing working conditions by self-report, either by aggregating self-reported working conditions to the job group level (job exposure matrix)<sup>60</sup> or the work-unit level,<sup>61</sup> by measuring working conditions by trained observers,<sup>62</sup> or by using information from registers to approximate working conditions.<sup>63</sup> As these alternative measures also have their own weaknesses, we suggest a triangulation approach to combine methods with different risk for over- and under-estimation of the exposure-outcome association.<sup>64</sup>

**Better understanding of biopsychosocial mechanisms.** Possible pathways that may link working conditions to mental health include dysregulation of the hypothalamic-pituitary-adrenal (HPA) stress axis, inflammatory processes, disturbance of circadian rhythm, loss of neuroplasticity, and inhibition of neurogenesis.<sup>65-69</sup> However, so far, knowledge about these pathways is very limited.

**Innovative analytic methods and study designs.** In recent studies on work and mental health, some of them not covered in systematic reviews as yet, innovative methods and study designs have been applied to strengthen causal inference. These include fixed effects regression, inherently controlling for unmeasured time-invariant confounding,<sup>70</sup> instrumental variable analyses,<sup>71</sup> and ‘emulated trials’ analysing change in exposure with subsequent change in mental health.<sup>72</sup>

**Life-course perspective.** Mental disorders have a complex multifactorial aetiology likely involving genetic, biological, psychological, and social risk factors that act over the life-course and that interact with each other.<sup>73-77</sup> Thus, working conditions are likely component causes in a multifactorial causal model of depressive disorders,<sup>78</sup> representing one part of the ‘exposome’, the totality of exposures individuals experience over the life course.<sup>79</sup> Consequently, it is key to analyse working conditions together with other life-domains, preferably over the life-course.

**Exacerbation, relapse, and recurrence.** Work environment research has focused mainly on first onset of mental disorders and little is known whether working conditions can contribute to the exacerbation or to the development of a mental health problems (e.g., distress or burnout) into a mental disorder (e.g., depressive disorder). Little is also known, whether working conditions can influence the chances of a relapse or recurrence.

**Understanding the role of context.** Some studies suggest that welfare state regime and national labour market policies modify the association between working conditions and mental health.<sup>80,81</sup> Societal structures may condition, modify, and shape working conditions and their impact on worker health.<sup>32</sup> Thus, a perspective that is restricted to individual-level risk factors of mental disorders, without a broader sociological perspective, may be too limited for fully understanding the relationships between working conditions and mental health.<sup>82,83</sup> See also paper 1 of the ‘Work and health’ series.<sup>17</sup>

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**Textbox 3 about here**

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## **Section 3: Protecting and promoting worker mental health and well-being**

In this section we provide an overview of the literature on prevention and promotion of workplace mental health. This evidence is heterogeneous by intervention outcomes (e.g., reducing job stressors, improving job quality, promoting early detection of mental health problems, preventing disorders and symptoms) and by intervention strategies (e.g., work-directed, worker-directed,

illness-directed). Hence, we narratively synthesise recent systematic reviews and umbrella reviews on the effectiveness of workplace mental health interventions alongside other emerging evidence, because the literature is not amenable to a single overview of reviews.

## **Principles and conceptual models for workplace mental health interventions**

Over the past decades, workplace mental health interventions have evolved relatively independently along three main threads: protection from harm, promotion of health and well-being, and addressing the needs of those potentially affected by mental health problems or disorders.<sup>26,84</sup>

The ‘integrated approach’ to workplace mental health combines these three threads in a comprehensive framework with complementary action areas : (i) *prevent harm*, i.e., protecting mental health by reducing risk factors for mental disorders and mental health problems, (ii) *promote the positive*, i.e., promoting mental health and well-being by developing the positive aspects of work and worker strengths and positive capacities, and (iii) *respond to problems*, by responding to potential mental health problems or disorders as they manifest in work contexts. This framework addresses both work- and non-work-related mental health; distils the complexity of this topic to three essential areas of action, avoids jargon and is accessible to workplace stakeholders; and encompasses organisational responses ranging from relatively simple strategies to mature programs incorporating numerous intervention elements.<sup>85</sup> Multiple intervention elements are required to address distinct targets and objectives (e.g., work, worker, manager), operating across the public health intervention levels of primary, secondary, and tertiary intervention,<sup>86</sup> corresponding to ‘universal’, ‘selected’, and ‘indicated’ in mental health terms.<sup>87</sup>



*The first thread, 'prevent harm'*, prioritises strategies assessing work-related risks to mental health (e.g., the job stressors described in the overview review above) and mitigating those risks to the extent feasible. This is both a common legal and ethical mandate in many countries.

*The second thread, 'promote the positive'*, entails developing the positive aspects of work (e.g., participatory job re-design to emphasise worker strengths) and positive capacities (e.g., worker 'resilience' and mindfulness programs). These interventions pursue positive outcomes (e.g., well-being, worker engagement), as opposed to being risk- or deficit-focused. Promoting the positive is not a legal requirement; however, it has a dual value in that positive mental health and well-being may buffer the impact of job stressors on mental health,<sup>88</sup> and promotes well-being, positive emotions, and optimal social and psychological functioning.<sup>7</sup>

*The third thread, 'respond to problems'*, entails a broad range of possible responses to mental health problems and disorders at work (whether or not caused by work), corresponding to the progression from subclinical mental health problems towards diagnosed mental disorders.<sup>89</sup> Strategies enabling safe and non-discriminatory help-seeking (e.g., through confidential Employee Assistance Programs) or help-offering (e.g., through Mental Health First Aid) can increase early detection when supports and treatments are optimally effective.<sup>90,91</sup> These activities are best supported by universal workplace mental health literacy and anti-stigma programs. For workers with more serious problems, referral pathways and access to treatment are essential. Upon recovery from a mental disorder, reasonable workplace accommodations may enhance return to work outcomes.<sup>92</sup> In some cases, though, moving to a different workplace or even a different type of job might be needed, which would entail the need for job training and maybe also financial support in the interim phase.<sup>93</sup> In many countries, there are relevant legal and ethical mandates under occupational safety and health, workers' compensation, anti-discrimination, disability employment, and other legislation.

The integrated approach is fundamentally principles-based, and the evidence regarding efficacy and effectiveness of particular intervention elements or strategies is summarised below. The WHO ‘Guidelines on mental health at work’, launched on 28 September 2022, align with our narrative review and include a series of evidence reviews grouped into the following six intervention areas: 1) organisational, 2) manager and worker training, 3) individual interventions, 4) return to work programs, 5) vocational support programs, and 6) screening programs.<sup>1</sup> In the accompanying joint WHO/ILO policy brief, three overarching strategies are expressed which overlap substantially with the integrated approach expressed above: 1) Prevent mental health conditions by reshaping work environments to reduce psychosocial risk, 2) Protect and promote worker mental by strengthening awareness, skills and opportunities for recognising and acting early on mental health issues, and 3) Support workers with mental health conditions to access, continue working, and thrive at work.<sup>2</sup>

## **Research evidence from workplace intervention studies**

Below, we report for each of the three threads the evidence for *worker-directed* and *work-directed* approaches. *Worker-directed* approaches, also called individual approaches, aim to improve the individual worker’s competencies, knowledge, and strengths to cope with working conditions. In contrast, *work-directed* approaches, also called organisational approaches, aim to improve working conditions and the organisation of work.

### ***Prevent harm***

There is considerable research about organisational interventions focusing on improving worker job control, a central element of the job strain model.<sup>51</sup> Reviews summarizing the evidence indicate that increasing workers’ control has positive effects on workers’ mental health.<sup>89,94</sup> Examples are participatory problem-solving groups,<sup>95,96</sup> and influence on shift-schedules.<sup>97,98</sup> These interventions

may be beneficial for mental health either directly through positive effects of experiencing more job control,<sup>99</sup> or, indirectly, via increased ability to influence other work-based risk factors.<sup>99,100</sup>

While the results on interventions concerning job control are fairly consistent, reviews about other types of workplace interventions reported mixed,<sup>101</sup> limited,<sup>102</sup> or no effects,<sup>103,104</sup> which might be due, at least partly, to sub-optimal implementation.<sup>105</sup> More research is needed evaluating the quality and intensity of implementation, especially in the light of research suggesting that changes in psychosocial working conditions need to be substantial to lead to measurable health effects.<sup>106</sup> The combination of organisational and individual approaches may be particularly efficacious,<sup>107</sup> a notion that is supported by reviews on the combination of organisational and individual interventions to reduce burnout.<sup>108-111</sup>

### ***Promote the positive***

‘Promoting the positive’ in workplace settings is a relatively recent and growing concept, but the evidence base is still limited.<sup>112-116</sup> Most reviews focus on individual-directed and only a few on organisational-directed interventions.<sup>112-114,116</sup>

One organisational approach studied extensively is manager and leadership training. These aim to increase managers’ knowledge, attitudes, and self-reported supportive behaviours towards workers experiencing mental health problems.<sup>89,117,118</sup> The evidence on the impact on worker mental health is limited as most studies did not measure worker outcomes; however, some studies found improvements in manager and supervisor skills and awareness.<sup>117,118</sup> Considering the central role of leaders and supervisors as role-models, decision makers, and facilitators of workplace changes, more research on the effects of leadership training is urgently needed.

### ***Respond to problems***

Individual approaches, such as supporting workers in coping with stressful situations or cognitive behavioural therapy (CBT)-based approaches, are widely tested and consistently show improvements in workers' stress and mental health symptoms.<sup>94,119</sup> However, the impacts of these interventions on long-term mental health and organisational outcomes such as absenteeism, presenteeism, and productivity are yet to be sufficiently studied.<sup>94</sup>

Mental Health First Aid<sup>120</sup> and work-place suicide prevention<sup>121</sup> have been shown to be useful approaches, but also need further development. Mental Health First Aid needs more studies in work settings<sup>122</sup> and suicide prevention needs to go beyond responding to acute distress and suicidal crises and shift upstream to reducing risk factors. While work-place suicide prevention shows some evidence of effectiveness,<sup>121,123,124</sup> particularly among emergency responders,<sup>125</sup> there is a need for greater attention to primary (universal) level intervention, such as reducing exposures to suicide-associated job stressors.<sup>126</sup>

Anti-stigma interventions have been shown to improve worker knowledge and supportive behaviour towards workers with mental health problems, supporting disclosure and more inclusive workplaces.<sup>127,128</sup>

Regarding recovery and return to work, qualitative studies and expert-based guidelines suggest that support from supervisors and colleagues, and workplace adjustments such as partial sickness absence, are effective.<sup>129,130</sup> CBT-based return-to-work programs (i.e., focussing on work-related concerns or development of work-related problem-solving skills) may both reduce depressive symptoms and improve occupational outcomes such as faster return to work.<sup>94</sup>

## Future directions for intervention research

Randomised controlled trials (RCTs) are considered the 'gold standard' for evaluating intervention efficacy and effectiveness. However, RCTs have limitations, in particular regarding complex workplace interventions that often cannot be fully randomised nor standardised and are influenced by the organisational and cultural context.<sup>131,132</sup> RCTs are more applicable to individual-level than organisational-level interventions, as organisational-level interventions require random assignment of distinct work units (cluster RCT designs) with each cluster counting as one observation. Further, key strategies for organisational-level interventions, such as participative approaches,<sup>133</sup> active and context-specific support by supervisors,<sup>117,134-136</sup> and the co-creation or co-design of mental health interventions,<sup>137</sup> are difficult to realize within an individual-randomised design. The focus on RCTs and meta-analyses may therefore lead to an overuse of narrow worker-directed intervention approaches (e.g., psychoeducation, mindfulness) and an underuse of more complex and resource and time-intensive work-directed approaches.<sup>109</sup>

The updated Medical Research Council (MRC) Framework for the Development and Evaluation for Complex Interventions to Improve Health may be particularly suitable for investigating multi-component workplace mental health programmes.<sup>138</sup> This framework allows the inclusion of measured multiple short-term and long-term mental health outcomes and potential intermediary factors (e.g., improved working conditions) that help to understand not only IF interventions work, but also HOW they work, i.e., through which pathways and mechanisms.<sup>138</sup>

'Realist evaluation' offers an approach to understanding how interventions work and how interventions can be affected by context.<sup>139,140</sup> In recent years, implementation research in occupational health has evolved, documenting barriers and facilitators of implementing workplace interventions,<sup>141-143</sup> some of them based on 'autopsies' of failed interventions.<sup>144,145</sup> A key

understanding is whether failure was due to shortcomings in the intervention programme theory or due to problems in the implementation, such as lack of fidelity of implementation, inadequate programme design, or lack of participation.<sup>146</sup> Systematic reviews, meta-analyses, and meta-synthesis of qualitative study results of process evaluations are urgently needed to better inform future research and practice.<sup>147</sup> Further insights for better understanding context may also be gained by involving workers with lived experience with mental health problems.

Recently, The European Commission funded, under the Horizon 2020 programme, large-scale European workplace intervention studies that aim to promote and protect workers' mental health, including a focus on implementation research. The projects are ongoing and their results in the upcoming years will likely have a considerable impact on future discussions about possibilities and challenges of workplace mental health interventions. Notably, intervention sites also include middle-income European countries such as Albania and Kosovo.<sup>148</sup> A description of the aims and methods of the projects can be found in a recorded Webinar<sup>149</sup> and in two study design/protocol papers of the H-WORK project<sup>150</sup> and the MENTUPP project,<sup>148</sup> respectively.

## **Future directions in workplace mental health policy and practice**

### ***Guidelines, policies, and standards supporting a strategic approach to mental health interventions***

Workplace wellness, well-being, and mental health promotion have become a billion dollar industry offering a vast selection of unregulated and unvalidated programmes.<sup>1,151</sup> Workplaces need authoritative evidence-informed guidance to help them navigate the flood of information and advice that is available.

Sweden (in 2015)<sup>152</sup> and Denmark (in 2020)<sup>153</sup> adopted legally binding regulatory approaches, mandating employers to regularly assess, improve, and monitor specific psychosocial risk factors at work, such as high workload, emotional demands, and workplace bullying.<sup>152,153</sup> Since 2015, Japan mandates the implementation of the Stress Check Program to monitor and prevent mental health problems at workplaces with 50 or more workers.<sup>154,155</sup>

Other governments have developed less binding national policies, standards, or guidelines. Examples are the UK Health and Safety Executive (HSE) Management Standards for Psychosocial Work Risks,<sup>156</sup> the UK National Institute for Health and Care Excellence (NICE) Guideline on Mental Well-being at Work,<sup>157</sup> and the Canadian National Standard for Psychological Safety in the Workplace.<sup>30</sup> At the international level, the International Organization for Standardization (ISO) recently published a Standard for Psychological Safety at Work.<sup>31</sup> Further, an international consortium of researchers and stakeholders, including WHO, has developed the European Framework for Psychosocial Risk Management (PRIMA-EF).<sup>158</sup> Finally, as previously mentioned, WHO recently published guidelines on ‘Mental health at work’,<sup>1</sup> accompanied by a WHO/ILO policy brief.<sup>2</sup>

The most notable features of these guidelines include the recommendation of a strategic organisation-wide approach integrating mental health interventions into existing policies and practices. These include medium- and long-term measures to improve working conditions and people management rather than ad-hoc solutions. All of these guidelines promote the continual monitoring and systematic assessment of psychosocial risks to develop needs-based interventions, and the design of healthy working conditions in partnership with workers. Other recommendations include the implementation of policies and procedures in organisations for supportive people management, e.g., training of supervisors, supportive leadership style, and integrating staff mental health and well-being levels, and intervention activities in company and manager performance

criteria.<sup>159</sup> Further, calls have been made recently for evidence-based workplace mental health policies on COVID-19 related impacts.<sup>160</sup>

While many guidelines specify WHAT to do, they are less explicit about HOW to implement interventions into daily business practice. Future practice endeavours should focus on the enhancement of guidelines, standards, and policies by adding implementation guidance, to facilitate their uptake and successful implementation across different contexts and industries.<sup>134,161</sup>

### ***Policies that address workplace mental health inequalities***

There is an urgent need for policy strategies to address workplace mental health inequalities.<sup>17</sup> Lower status workers are the most exposed to mental health-adverse working conditions yet are the least likely to be provided with workplace mental health intervention.<sup>26,84</sup> Working conditions of lower status workers are often more rigid and less amenable for modifications than working conditions of higher status workers. Further, low-wage workers have usually little or no latitude for accommodating workload by reducing working hours. If not redressed, this situation could contribute unintentionally to the widening of mental health inequalities. This topic is covered in greater detail in paper 1 in this 'Work and health' series.<sup>17</sup>

### ***Implications for medical practice***

Clinicians, including General Practitioners, play an important role in assessing, diagnosing, and assisting individuals with work-related mental health disorders and problems, and are often the first point of contact. Studies suggest, however, that work hazards are rarely considered in the clinical assessment and management of mental disorders,<sup>162,163</sup> and few cases are reported to an occupational health service.<sup>164</sup> Some clinical practice guidelines are available,<sup>165</sup> including guidance on how to determine the work-relatedness of a mental health problem, early identification, communication with the patient's workplace, and strategies for facilitating return to work.



Understanding working conditions can also help in determining why recovery from a mental health problem is delayed, as well as in how return-to-work can be best managed.<sup>162,163</sup>

### ***Future developments***

Several important societal developments may considerably impact workplace mental health in the future, including increasing digitalization and telework (partly caused by the COVID-19 pandemic), large migrant labour workforces, the emergence of the gig economy, or the increase in precarious employment. These and other topics are comprehensively discussed in paper 1 of the ‘Work and health’ series.<sup>17</sup>

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**Textbox 4 about here**

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## **Section 4: Conclusions and recommendations**

Workplace mental health is scientifically informed by epidemiological research into work-related determinants of mental health and by intervention and implementation research. This research has grown rapidly and has generated important insights over the last two decades. There is, however, a need to further develop the evidence base 1) to consolidate our understanding of the problems (e.g., to improve causal inference with regard to risk and protective factors and mechanisms of action), and 2) to more comprehensively devise, implement and evaluate specific interventions (e.g., co-design strategies, mixed methods implementation evaluation, and effectiveness studies). Almost all high-quality research evidence on work and mental health stems from high-income countries and more and better research from low- and middle-income countries is urgently needed.

The workplace offers considerable potential to influence mental health by preventing harm and promoting the positive aspects of work, and by facilitating timely, safe and non-discriminatory support for those showing signs of mental health problems at work. Realising this potential requires a collaborative approach involving all key stakeholders, including governments, employers and employer organizations, workers and unions, workers with lived experience with mental health problems, occupational health service providers, non-governmental organisations (NGOs), occupational health and safety professionals, and clinical practitioners.

Based on the research evidence summarised above, we make the following recommendations to policy makers and stakeholders.

**Recommendation one: Regulate and control working conditions for which scientific evidence suggests an increased risk of mental health problems and mental disorders.**

Based on the precautionary principle, policy makers, at the local, national and international level, should regulate and control exposure to those working conditions for which high quality research studies suggest a contribution to the development of mental health problems and mental disorders. This is further supported by the ethical – and in many jurisdictions legal – mandate for employers to provide psychologically safe work. Prevalent practice over-emphasises individual- and illness-directed interventions, but underemphasises work-directed preventive interventions—which should be the focus of workplace health and safety regulators. This aligns with Recommendation #1 in the 2022 WHO ‘Guidelines on mental health at work’.

**Recommendation two: Develop and improve policy and guidance on mentally healthy workplaces with a particular focus on unskilled and low-wage workers.**

Improved policy and guidance on mentally healthy workplaces is needed for all workers and work contexts, but improved working conditions and mental health services should be prioritised for

marginalized, low skilled and low wage workers because these workers are disproportionately affected by mental health problems and poor psychosocial working conditions (see also paper 1 on ‘Work as a social determinant of health’ of the ‘Work and Health’ series). Policy and guidance should not be limited to individual-directed interventions but must include organisational-directed interventions. Interventions should be rigorously monitored and evaluated to further inform evidence and improve practice.

**Recommendation three: Develop policy and guidance on how to create and maintain mentally healthy workplaces, including all levels of an organisation, and systematic professional capacity building and training programmes for supervisors and occupational health and safety professionals.**

In addition to policy and guidance on mentally healthy work, there is a need for policy and guidance on how to do that. Workplace mental health should be made a collective concern at all levels of the organisation. This requires better guidance for how mentally healthy workplaces can be created, which also requires systematic professional capacity building and training programmes for supervisors and occupational health and safety professionals, to facilitate implementation and maintenance of mentally healthy workplaces. This recommendation aligns with Recommendation #4 in the 2022 WHO ‘Guidelines on mental health at work’.

**Recommendation four: Improve government support and workplace conditions to enable individuals with mental health problems and mental disorder to be a part of the workforce.**

A healthy workplace with good working conditions can provide enormous benefits for individuals with mental health problems and mental disorders (see also paper 3 on ‘Health and inclusive labour force participation’ of the ‘Work and Health’ series). Government and other policy makers should provide structural conditions and support for workplaces to enable them to be more inclusive of workers with mental health problems and mental disorders. Organisational commitment to

diversity, equity, and inclusion should encompass the provision of working conditions that enable individuals with mental health problems and mental disorders to participate in the workforce. This also entails the provision of strategies to support safe return to work after periods of sickness absence due to mental health problems and mental disorders, including adjustments in working tasks and working conditions. This recommendation aligns with Recommendations #3, #11 and #12 in the 2022 WHO 'Guidelines on mental health at work'.

**Recommendation five: Routinely include work and working conditions in the clinical assessment, diagnosis, and management of mental health problems and mental disorders.**

General practitioners, psychiatrists, psychologists, nurses, and other clinicians and health professionals should routinely include information about work and working conditions in their clinical assessment, diagnosis, and management of mental health problems and mental disorders. Clinical guidelines and standards for General practitioners and other health professionals need to be developed specifying how to assess and manage work-related mental health issues. These should be coupled with systematic education and training programmes.

**Recommendation six: Ensure that the workplace is an integral part of governmental mental health strategies and build societal awareness about the importance of workplace mental health.**

If workplace mental health should be successful, activities must reach beyond the workplace and embrace society as a whole. A general societal awareness should be built about the importance of workplace mental health. This includes advocacy and campaigns to increase mental health literacy in all parts of society, the destigmatisation of mental health problems and mental disorders, and the promotion of mental well-being as a positive concept. The joint and complementary efforts of stakeholders at all levels, workplace, government, civil society, is essential to the pursuit of mentally healthy work for all.

## **Contributors**

RR and IEHM had the original idea for this paper and drafted the first outline of the manuscript. RR and IEHM conducted the overview of reviews. The quality of the review studies were assessed by RR, BA, BAG, NK, and IEHM. RR drafted the sections on “Introduction, structure and approach” and “The aetiological role of working conditions in the development of mental disorders” with the assistance of IEHM and NK, and all other authors critically revised the draft. ADL drafted an improved outline of the section on “Protecting and promoting worker mental health and well-being”, BA, BAG, EA, and ADL jointly drafted this section, and all other authors critically revised the draft. All authors reviewed several versions of the full manuscript and provided additional feedback. RR, IEHM and ADL led and all other authors substantially contributed to the revision of the manuscript for the second and third submission to the journal. All authors approved the final version of the manuscript for submission.

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The authors declared no conflicts of interest.

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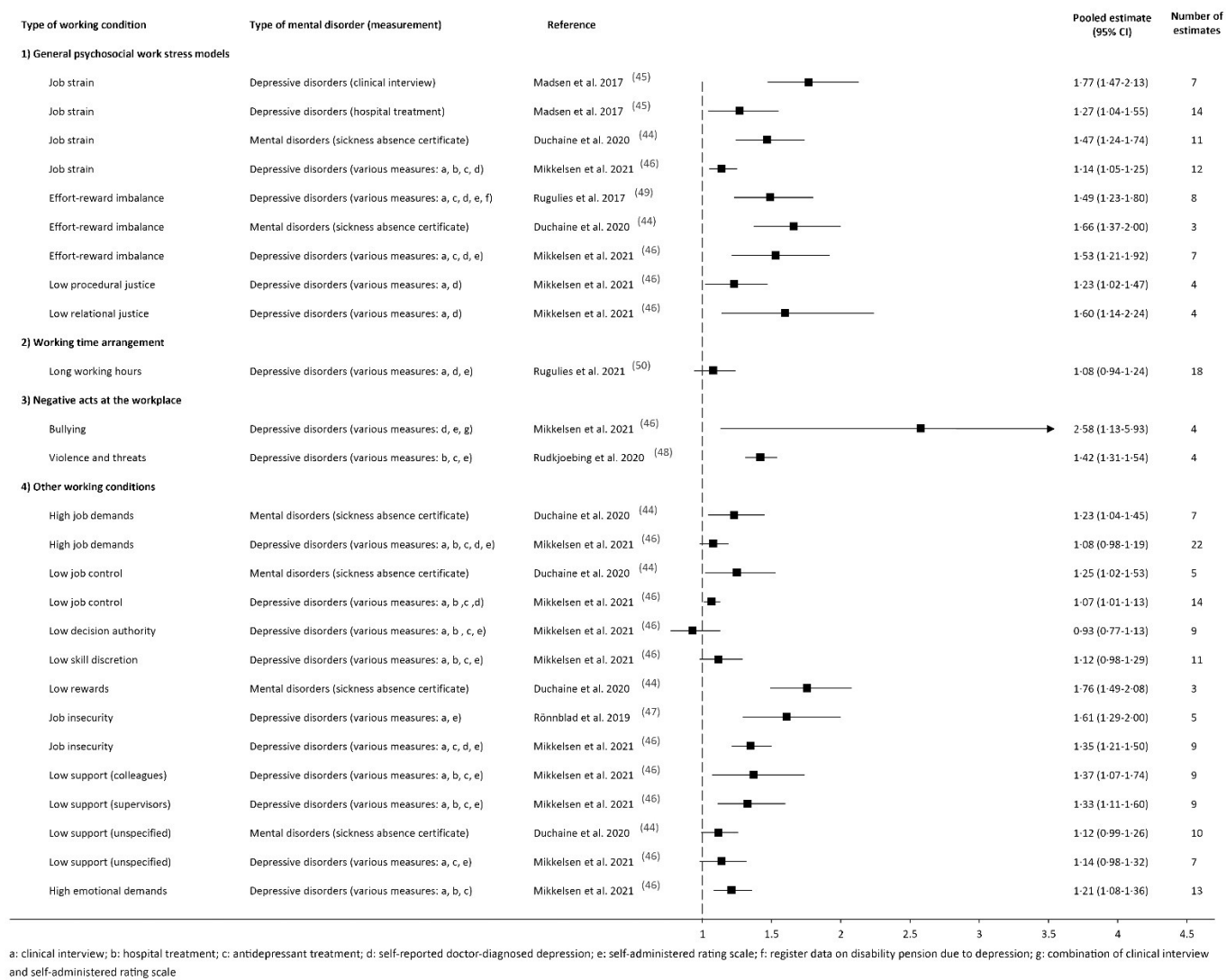
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## **FIGURES and TEXTBOXES**



**Figure 1. Forest plot on working conditions and onset of mental disorders from seven systematic reviews**

### **Textbox 1: Mental health definitions**

- *Mental disorders* are clinical phenomena, such as depressive disorders, anxiety disorders, or schizophrenia, recognized with a code in diagnostic manuals.<sup>5</sup>
- *Mental health problems* include a broader range of mental health conditions also encompassing subclinical and subthreshold disorders or conditions not recognized as a medical condition in diagnostic manuals, e.g., psychological distress and burnout.<sup>6</sup>
- *Mental well-being* is a positive construct (not framed in terms of deficits or limitations), encompassing thriving and actualization, positive feelings, and positive social and psychological functioning.<sup>7</sup>

**Textbox 2: Key messages about prevalence and importance of workplace mental health**

- Mental health problems and mental disorders are common in the working population, especially among lower status workers.
- Mental disorders are important determinants of work disability, sickness absence, unemployment, permanent exit from employment, and lower lifetime earnings and income, incurring significant costs for workers, employers, and society.

**Textbox 3: Key messages about the aetiological role of working conditions for mental disorders**

- There is consistent evidence from prospective cohort studies demonstrating associations between exposure to adverse working conditions and risk of depressive disorders.
- These associations indicate that working conditions are likely important modifiable determinants of mental health, however, uncertainties remain due to possible biases.

**Textbox 4: Key messages about protecting and promoting worker mental health and well-being**

- Integrated intervention strategies have gained traction and may improve both working conditions and worker mental health.
- In practice, most interventions focus on the individual level only; more proactive interventions to improve work organisation and working conditions need to be developed and implemented to meet legal and ethical mandates to provide psychological safe work.
- Improvements in collaborative interdisciplinary approaches involving all relevant stakeholders are essential to develop and implement co-designed and context-specific interventions.

# Supplementary appendix

Supplementary appendix to the article:

Rugulies R, Aust B, Greiner BA, Arensman E, Kawakami N, LaMontagne AD, Madsen IEH. Work and mental health: Discussion paper on aetiology and interventions. Lancet 2023.

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## Supplementary appendix S1: Definition of mental health

We distinguish three types of mental health phenomena at the workplace: (i) Mental disorders, (ii) Mental health problems, and (iii) Mental well-being.

*Mental disorders* are clinical entities that have a code recognized in diagnostic manuals, such as the ICD-11 (International Classification of Diseases and Health Related Problems, 11th revision)<sup>1</sup> or the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, 5th revision).<sup>2</sup> Both the ICD and the DSM are revised on a regular basis, where disorders are added or removed from the lists and diagnostic criteria are changed. These revision processes have developed into major enterprises that take now several years and that are increasingly accompanied by critical comments and intense and controversial debates.<sup>3,4</sup> These debates include fundamental and philosophical discussions about the “nature” of mental disorders,<sup>5,6</sup> and the “pathologisation” and “medicalisation” of misery versus the “normalisation” of severe and treatable disorders.<sup>7-9</sup> It is also debated whether the dichotomised classification in presence or absence of mental disorders in ICD-10/ICD-11 and DSM-5 is appropriate or should be better replaced with a dimensional understanding of psychopathology, where mental health phenomena are located on a continuous scale.<sup>10,11</sup> The putative causes of mental disorders, though, are rarely discussed today in debates about the diagnostic manuals. Since the paradigm shift in psychiatry in 1980 (with the release of the DSM-III),<sup>12</sup> diagnostic manuals take, with the exception of a few disorders, an agnostic and atheoretical approach towards aetiology and pathophysiological processes.<sup>13</sup> Thus, mental disorders are not diagnosed based on assumed internal (e.g., psychodynamic processes) or external (e.g. experienced trauma) causes but are diagnosed based on the presence or absence of defined symptoms and distress.

The diagnostic manuals and their codes have great importance for decisions in clinical medicine and social administration, for example about type of treatment, hospitalization or discharge, billing of health insurance companies, issuing of sick leave certificates, or granting of disability pensions. Mental disorders that are of particular interest for occupational health research include for examples depressive disorders and bipolar disorders, anxiety disorders, posttraumatic stress disorder (PTSD), adjustment disorders, and substance use disorders.

*Mental health problems* include a broader range of mental health conditions than those that are recognized in diagnostic manuals. Thus, mental health problems encompass mental disorders but are not limited to mental disorders. Instead mental health problems include experiencing disorder-related symptoms below the frequency or severity thresholds for classification as disorders, and subclinical mental disorders, which are less severe in terms of distress or impairment in social, occupational, or other important areas of functioning. Mental health problems can also include conditions that are by definition work-related, such as burnout.<sup>14,15</sup>

*Mental well-being* differs qualitatively from mental disorders/mental health problems, as mental well-being addresses the positive and not the negative, and is not about deficits and limitations but is about thriving and actualization, positive feelings, and social and psychological functioning.<sup>16,17</sup> This is in agreement with the World Health Organization (WHO) definition of mental health as “a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community”.<sup>18</sup>

**Table S1-1** delineates the relation of mental disorders, mental health problems, mental well-being. Mental health problems and mental disorders are related to each other, with mental health problems being the broader concept, encompassing mental disorders. Mental well-being, though, is a different phenomenon, characterised by its dimensional nature. **Table S1-1** also includes an overview how mental disorders, mental health problems, and mental well-being are related to workplace research and practice.



**Table S1-1: The relation of mental disorders, mental health problems, and mental well-being and the related roles of occupational research and practice**

Type of mental health issues at work	Roles in occupational research and practice
<p><b>Mental disorders</b> Disorders are defined in diagnostic manuals and usually characterised by substantial levels of both distress and impairment, e.g., depressive disorders, anxiety disorders, psychotic disorders, or personality disorders.</p>	<ul style="list-style-type: none"> <li>- Identify working conditions contributing to the development or the exacerbation of mental disorders.</li> <li>- Develop workplace interventions that remove or at least mitigate the risk factors.</li> <li>- Develop workplace interventions that help workers with mental disorders to live fulfilling working lives, regardless whether the disorder is caused by work or not. This includes also reducing stigma of mental disorders at work.</li> <li>- Develop interventions (at the workplace and outside the workplace) that help individuals with mental disorders to remain a part of the workforce and to return safely to work after longer periods of (sickness) absence.</li> </ul>
<p><b>Mental health problems</b> A broader concept than mental disorders that includes both mental disorders but also symptoms and discomfort that affect the worker while not fulfilling the diagnostic criteria of a mental disorder. Examples are feelings of tension, disturbed sleep, exhaustion, burnout or psychological distress, but also depressive or anxiety symptoms that are not pronounced enough for diagnosing a depressive or anxiety disorder.</p>	<ul style="list-style-type: none"> <li>- Same as above with regard to mental disorders, identify working conditions that are risk factors for mental health problems and remove or mitigate the risk factors. Help the affected workers to live fulfilling working lives, regardless whether the mental health problems are caused by work or not.</li> <li>- The removal or mitigation of occupational risk factors of mental health problems and the support of workers with mental health problems may in some cases help to prevent the development of a mental disorder.</li> </ul>
<p><b>Mental well-being</b> The focus is not on the negative but on the positive, on thriving and realizing the full potential of mental well-being and functioning.</p>	<ul style="list-style-type: none"> <li>- Identify resources at work that enhance mental well-being and that facilitate the realization of workers' full mental health potential.</li> <li>- Develop strategies to organise work in a way that allow workers to thrive and to realize their full mental health potential.</li> </ul>

## Supplementary appendix S2: Methods for the overview of reviews

### Design and aim of the overview of reviews

To provide an overview of the current evidence about the association between work environment and risk of mental disorders, we conducted an overview of systematic reviews, also known as “umbrella review” or “meta-review”.<sup>19,20</sup> Overviews of reviews were developed in response to the rapidly increasing number of systematic reviews and meta-analyses in many research fields.<sup>21</sup> They synthesise the results of published systematic reviews and meta-analyses and therefore can provide researchers and policy makers with the most comprehensive overview possible of the research evidence.<sup>19,20</sup>

### Types of population

- Working age population (≥15 years), worldwide.

### Types of exposure

- All types of exposures at the workplace, including physical, chemical, ergonomic, and psychosocial working conditions.
- Exclusion: Non-work environment exposures, such as workers’ characteristics, personalities, or health-behaviours.

### Types of comparators

- Comparator are individuals not exposed to the exposure of interest.

### Types of outcome

- Mental disorders as defined in diagnostic manuals that is either the Classification of Diseases and Health Related Problems, 10th revision (ICD-10) by the WHO<sup>22</sup> (as ICD-11 only became into effect from 2022 onwards) or the Diagnostic and Statistical Manual of Mental Disorders, 5th revision (DSM-5) by the American Psychiatric Association.<sup>2</sup>
- Exclusion: Mental health problems that are not recognized as mental disorders in the ICD-10 or the DSM-5, such as reduced mental well-being, distress, or burnout.

### Types of studies

- Systematic reviews with meta-analysis, published in peer-reviewed scientific journals that included original studies examining the association between working conditions and risk of mental disorders.
- Exclusion: Reviews in which the majority of studies were cross-sectional studies.
- Exclusion: Reviews with key results that had been reported in another included review.

### Types of effect measures

- A measure of relative risk (hazard ratio, rate ratio, odds ratio) that estimates the risk of a mental disorder in the exposed group compared to the unexposed group. Effect measures had to be based on cohort studies or nested case-control studies, effect estimates based on simple case-control studies or on cross-sectional studies were not eligible.

### Literature search

- Academic electronic database: Search of PubMed on 11 December 2021.
- Publication period: 1 January 2017 to 11 December 2021.
- Publication language: English.
- Search string: (((Work OR Occupation OR Occupational OR Job)) AND (Mental OR Psychiatric OR Depression OR Depressive OR Bipolar OR Affective OR Anxiety OR Functional Disorder OR Alcohol OR Substance OR Psychotic OR Schizophrenia OR Suicide) AND (Prospective OR Longitudinal OR Cohort OR Follow-up OR “Nested case control”) AND (Review[Title] OR "Meta-analysis"[Title])) AND (("2017"[Date - Publication] : "3000"[Date - Publication])).
- Hand search (literature list of included reviews, own files).

### Selection of studies

- All records identified in the search were downloaded in an Endnote database. One review author (RR) screened titles and abstract for potential eligibility. Next, potentially eligible articles were read full-text by

one reviewer (RR). Reason for inclusion and exclusion was documented. The list of included and excluded articles and the reason for inclusion and exclusion were then checked by a second reviewer (IEHM). Disagreements between the first and second reviewer were solved by discussion.

#### **Quality assessment of the reviews**

- We assessed the quality of the included reviews with the “Health Evidence Quality Assessment Tool” that provides an overall score differentiating between reviews of weak ( $\leq 4$  points), moderate (5-7 points), and strong (8-10 points) quality.<sup>23</sup> The scoring scheme is depicted in **Figure S2-1**.
- The assessment were conducted independently by pairs of two reviewers (RR, BA, BAG, NK, IEHM). We ensured that reviewers were not assigned to papers that they had authored or co-authored. Disagreements between the reviewers were solved by discussion, or, if this was not possible, by assigning a third reviewer who made the decision.

#### **Assessment certainty of evidence**

- Two reviewers (RR and IEHM) assessed the certainty of evidence by reviewing the extracted estimates and by considering reasons for increasing and decreasing our confidence in the estimates.
- This assessment was documented in a draft text that was reviewed, edited, and approved by all authors.

Figure S2-1. Quality Assessment Scoring Sheet

<b>Health Evidence                      Quality Assessment Tool                      Revised version</b>		
Reference (Author, Title, Journal): Reviewer Name:		
CRITERION	Yes	No
<b>Q1:</b> Are the population, intervention/exposure and outcome clearly described in the research question or inclusion criteria?		
<b>Q2:</b> Were appropriate inclusion criteria used to select primary studies?		
<b>Q3:</b> Did the authors describe a search strategy that was comprehensive? (at least two strategies from each column)  <i>Add an X for all strategies used</i> <ul style="list-style-type: none"> <li>• Health databases</li> <li>• Psychological databases</li> <li>• Social science databases</li> <li>• Educational databases</li> <li>• Other</li> <li>• Handsearching</li> <li>• Key informants</li> <li>• Reference lists</li> <li>• Unpublished</li> </ul>		
<b>Q4:</b> Did the search strategy cover an adequate number of years?		
<b>Q5:</b> Did the authors describe the level of evidence in the primary studies included in the review?  <i>Insert an X for the appropriate level of evidence</i> <ul style="list-style-type: none"> <li>• Level I → RCTs only</li> <li>• Level II → Non-randomized, cohort, case-control</li> <li>• Level III → Uncontrolled studies</li> </ul>		
<b>Q6:</b> Did the review assess the methodological quality of the primary studies?  Place a check mark in the Yes column if the following <b>three</b> criteria are met: <ol style="list-style-type: none"> <li>1. Each primary study should be assessed for methodological quality using a standardized assessment tool/scale.</li> <li>2. A minimum of four (including all of the first three bullet points (research design, data collection methods and follow-up/attrition rate) out of the following seven areas should be assessed and the results described for each included primary study:                             <ul style="list-style-type: none"> <li>• <b>Research design</b></li> <li>• <b>Data collection methods</b></li> <li>• <b>Follow-up rates / attrition rates</b></li> <li>• Study sample</li> <li>• Participation rates</li> <li>• Data analysis</li> <li>• Sources of bias</li> </ul> </li> <li>3. The implication of the quality-related data on the review’s findings must be addressed</li> </ol>		
<b>Q7:</b> Are the quality of the primary studies assessed by a minimum of two authors and the method of conflict resolution described? <b>OR:</b> Are an inter-rater agreement Kappa score of at least 0.80 reported?		
<b>Q8:</b> Was it appropriate to combine the findings of results across studies?		
<b>Q9:</b> Were appropriate methods used for combining or comparing results across studies?		
<b>Q10:</b> Do the data support the author’s interpretation?		
TOTAL SCORE		
<b>Quality Assessment Rating:</b> <b>Strong: 8-10</b> <b>Moderate: 5-7</b> <b>Weak: 4 or less</b>		

## Supplementary appendix S3: Results from the overview of reviews

### Overview of included and excluded studies

**Figure S3-1** shows the PRISMA flowchart of the study selection. We identified 1,242 records in the PubMed search and an additional three records in the hand search, yielding a total of 1,245 records. After title and abstract screening, we excluded 1,214 records, leaving 31 records for full-text screening. We excluded 24 records after full-text screening, yielding seven articles for the rapid review.<sup>24-30</sup>

The two reviewers agreed on the reasons for inclusion/exclusion on 26 of the 31 papers, thus they disagreed on five papers (83.9% agreement, kappa=0.80). On two papers there was disagreement whether or not the paper should be included and on three further papers there was disagreement on the reason for exclusion. After discussion, all disagreements were solved. The original decision of reviewer 1 was changed in two cases, including one case where the status of the study was changed from excluded to included.

The references of the seven included reviews and the key characteristics of the studies are listed in **Table S3-1**. Virtually all primary studies in the reviews came from high-income countries. Most primary studies included both women and men and covered a broad age range.

The references of the 24 reviews that were excluded after full-text screening and the rationale for their exclusion are listed in **Table S3-2**.

**Table S3-3** shows the quality assessment of the reviews. Of the seven reviews, five were rated of strong, two of moderate, and none of weak quality.

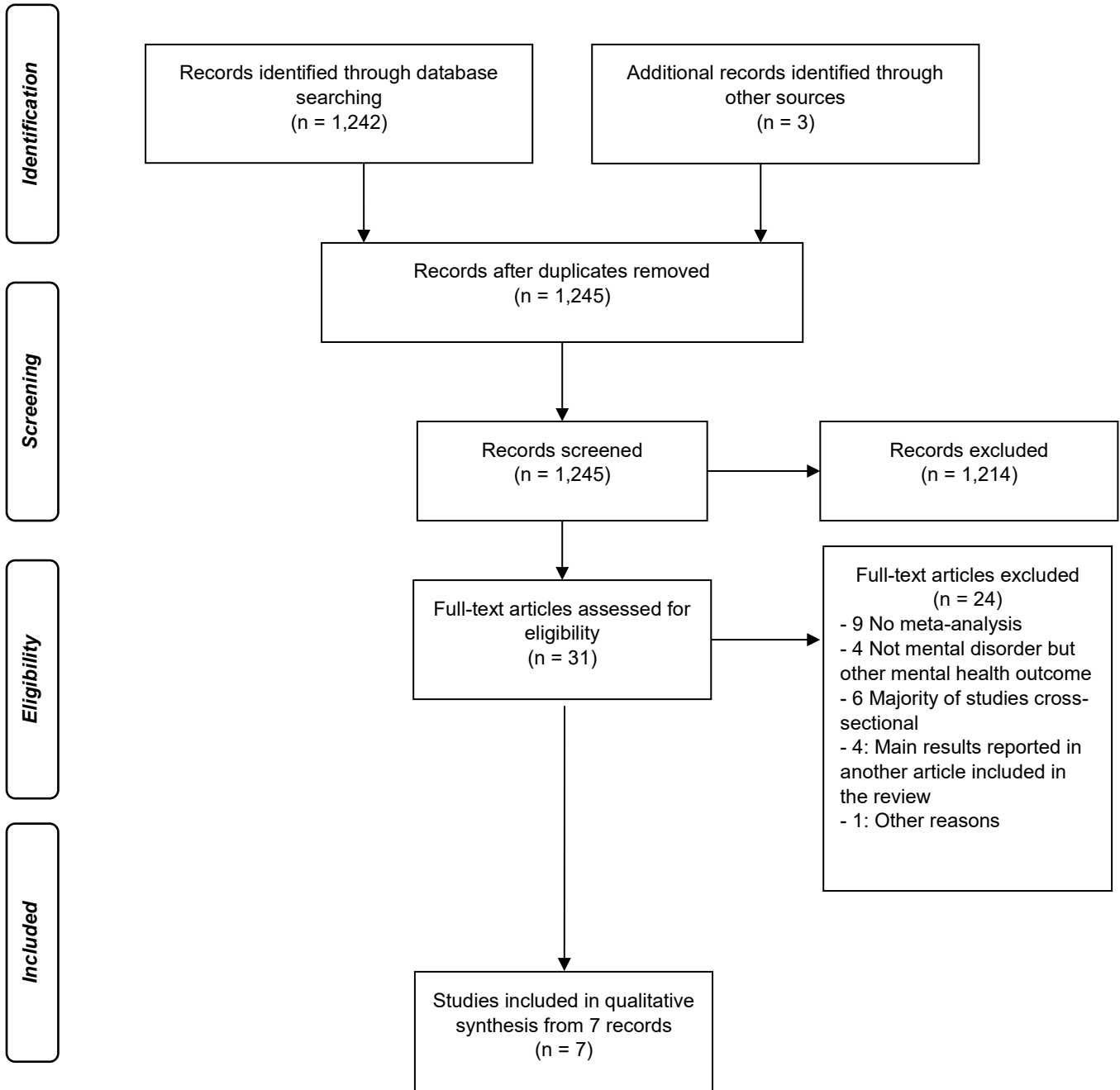
### Summary of results

**Figure 1**, which is presented in the main text of this paper, summarises the key results from the seven reviews. The vast majority of the results pertained to the association between working conditions and risk of depressive disorders.

We categorised working conditions in four groups, inspired by previous categorizations in the work and health literature,<sup>31,32</sup> “General psychosocial work stress models”, “Working time arrangement”, “Negative acts at the workplace” and “Other working conditions”.

- **General psychosocial work stress models**, i.e., job strain, effort-reward imbalance, and low organisational justice, predicted risk of depressive disorders, or sickness absence due to mental disorders, or both. Estimates were between 1.14 (95% CI: 1.05 to 1.25) to 1.77 (95% CI: 1.47 to 2.13).
- **Working time arrangement** was limited to one review on long working hours. This review did not show a clear associations with mental disorders 1.08 (95% CI: 0.94 to 1.24). One review also reported estimates for shift work and night work,<sup>26</sup> however, the estimates were partly based on cross-sectional studies and were therefore not included in this overview.
- **Negative acts at the workplace** included in this review workplace bullying and workplace violence and threats, which both were associated with risk of depressive disorders, with estimates of 2.58 (95% CI: 1.13 to 5.93, workplace bullying) and 1.42 (95% CI 1.31 to 1.54, workplace violence and threats), respectively. The estimate for workplace bullying was the by far strongest estimate among all estimates included in this review.
- **Other working conditions** included mainly single components of the general psychosocial work stress models and a few additional factors. The estimates ranged from 0.93 (95% CI: 0.77 to 1.13) for low decision authority to 1.76 (95% CI: 1.49 to 2.08) for low rewards at work.

Figure S3-1. Flow diagram of study selection



**Table S3-1. Characteristics of the systematic reviews that were included in the overview of reviews**

ID	Reference	PECOs: Population, Exposure, Comparator, Outcome	Number of: a) primary studies in meta-analysis; b) primary studies not included in other reviews; c) pooled estimates we extracted for the overview of reviews	Countries, Gender, Age in the primary studies
1.	Duchaine CS, Aubé K, Gilbert-Ouimet M, et al. Psychosocial stressors at work and the risk of sickness absence due to a diagnosed mental disorder: a systematic review and meta-analysis. <i>JAMA Psychiatry</i> 2020; <b>77</b> (8): 842-51.	<b>Population:</b> Working adults. <b>Exposure:</b> Work stress, as described in three theoretical models: Job strain; Effort-reward imbalance; Organisational justice. <b>Comparator:</b> Non exposed workers. <b>Outcome:</b> Sickness absence with a diagnosed mental disorder.	<b>Primary studies in meta-analysis:</b> 13 <b>Primary studies not included in other reviews:</b> 12 <b>Pooled estimates extracted for the overview review:</b> 6	<b>Countries:</b> Canada (5), Finland (3), Japan (2), Sweden (1), The Netherlands (1), UK (1). <b>Gender:</b> 11 studies women and men, 1 study women only, 1 study men only. <b>Age:</b> 15 to 64 (age range); 35 to 50 (mean age range).
2.	Madsen IEH, Nyberg ST, Magnusson Hanson LL, et al. Job strain as a risk factor for clinical depression: systematic review and meta-analysis with additional individual participant data. <i>Psychol Med</i> 2017; <b>47</b> (8): 1342-56.	<b>Population:</b> (a) All type of workers for systematic review; (b) Workers participating in cohorts of the IPD-Work consortium for analyses of unpublished individual participants studies. <b>Exposure:</b> Job strain. <b>Comparator:</b> Non exposed workers. <b>Outcome:</b> Depressive disorders.	<b>Primary studies in meta-analysis:</b> 20, including 6 in population (a) and 14 in population (b) <b>Primary studies not included in other reviews:</b> 14 <b>Pooled estimates extracted for the overview review:</b> 2	<b>Countries:</b> Denmark (7), Sweden (4), Finland (3), Canada (2), UK (2), France (1), The Netherlands (1). <b>Gender:</b> All studies included both women and men. <b>Age:</b> 40 to 47 (mean age range, population (a)); 16 to 65 (age range, population (b)).
3.	Mikkelsen S, Coggon D, Andersen JH, et al. Are depressive disorders caused by psychosocial stressors at work? A systematic review with metaanalysis. <i>Eur J Epidemiol</i> 2021; <b>36</b> (5): 479-96.	<b>Population:</b> Adult workers. <b>Exposure:</b> All types of psychosocial stressors at work. <b>Comparator:</b> Non exposed workers. <b>Outcome:</b> Depressive disorders. Note: The review included 54 studies and 20 meta-analyses, not all studies and meta-analyses were included (e.g., if pooled estimates were partly based on cross-sectional studies).	<b>Primary studies in meta-analysis:</b> 35 <b>Primary studies not included in other reviews:</b> 22 <b>Pooled estimates extracted for the overview review:</b> 14	<b>Countries:</b> Denmark (15), Finland (8), Canada (4), Germany (2), Sweden (2), France (1), Italy (1), The Netherlands (1), UK (1). <b>Gender:</b> One study included women only, the remaining studies included both women and men. <b>Age:</b> 16 to 74 (age range).
4.	Rönblad T, Grönholm E, Jonsson J, et al. Precarious employment and mental health: a systematic review and meta-analysis of longitudinal studies. <i>Scand J Work Environ Health</i> 2019; <b>45</b> (5): 429-43.	<b>Population:</b> Human subjects of working age active in the labour market. <b>Exposure:</b> Job insecurity. <b>Comparator:</b> Non exposed workers. <b>Outcome:</b> Depressive disorders. Note: This review was about precarious employment and mental health, analysing different indicators of precarious employment and different indicators of mental health. The only qualifying meta-analysis was on job insecurity and depressive disorders. Although the authors called the outcome “depressive symptoms”, reading of the included articles revealed that all studies were about depressive disorders.	<b>Primary studies in meta-analysis:</b> 5 <b>Primary studies not included in other reviews:</b> 2 <b>Pooled estimates extracted for the overview review:</b> 1	<b>Countries:</b> Canada (1), Denmark (1), France (1), Sweden (1), The Netherlands (1). <b>Gender:</b> All studies included both women and men. <b>Age:</b> 20-74 (age range).

ID	Reference	PECOs: Population, Exposure, Comparator, Outcome	Number of: a) primary studies in meta-analysis; b) primary studies not included in other reviews; c) pooled estimates we extracted for the overview of reviews	Countries, Gender, Age in the primary studies
5.	Rudkjoebing LA, Bungum AB, Flachs EM, et al. Work-related exposure to violence or threats and risk of mental disorders and symptoms: a systematic review and meta-analysis. <i>Scand J Work Environ Health</i> 2020; <b>46</b> (4): 339-49.	<p><b>Population:</b> All type of workers.  <b>Exposure:</b> Violence and threats of violence at work.  <b>Comparator:</b> Non exposed workers  <b>Outcome:</b> Depressive disorders.</p> <p>Note: The review also included estimates for depressive symptoms, anxiolytics, anxiety symptoms, burnout, psychological distress, and sleep impairment that did not fulfil the eligibility criteria.</p>	<p><b>Primary studies in meta-analysis:</b> 4  <b>Primary studies not included in other reviews:</b> 3  <b>Pooled estimates extracted for the overview review:</b> 1</p>	<p><b>Countries:</b> Denmark (2), USA (2).  <b>Gender:</b> Not reported.  <b>Age:</b> Not reported.</p>
6.	Rugulies R, Aust B, Madsen IEH. Effort-reward imbalance at work and risk of depressive disorders. A systematic review and meta-analysis of prospective cohort studies. <i>Scand J Work Environ Health</i> 2017; <b>43</b> (4): 294-306.	<p><b>Population:</b> Economically active individuals.  <b>Exposure:</b> Effort-reward imbalance.  <b>Comparator:</b> Non exposed workers.  <b>Outcome:</b> Depressive disorders.</p>	<p><b>Primary studies in meta-analysis:</b> 8  <b>Primary studies not included in other reviews:</b> 2  <b>Pooled estimates extracted for the overview review:</b> 1</p>	<p><b>Countries:</b> Finland (3), Denmark (2), Canada (1), USA (1), Study with 12 European countries (1).  <b>Gender:</b> All studies included both women and men.  <b>Age:</b> 40 to 45 (mean age range).</p>
7.	Rugulies R, Sørensen K, Di Tecco C, et al. The effect of exposure to long working hours on depression: A systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. <i>Environ Int</i> 2021; <b>155</b> : 106629.	<p><b>Population:</b> Individuals of working age (<math>\geq 15</math> years) in the formal and informal economy.  <b>Exposure:</b> Long working hours.  <b>Comparator:</b> Non exposed workers.  <b>Outcome:</b> Depressive disorders.</p>	<p><b>Primary studies in meta-analysis:</b> 17  <b>Primary studies not included in other reviews:</b> 15  <b>Pooled estimates extracted for the overview review:</b> 1</p>	<p><b>Countries:</b> USA (4), Canada (3), Australia (2), Denmark (2), UK (2), Finland (1), Republic of Korea (1), Sweden (1), Study with 27 European countries plus Israel (1).  <b>Gender:</b> All studies included both women and men.  <b>Age:</b> 18 to 64 (age range).</p>



**Table S3-2. Records that were excluded after full-text screening from the rapid review with reasons for exclusion**

ID	Reference	Reason for exclusion
1.	Arango C, Dragioti E, Solmi M, et al. Risk and protective factors for mental disorders beyond genetics: an evidence-based atlas. <i>World Psychiatry</i> 2021; <b>20</b> (3): 417-36.	Results reported in another review article. This is an evidence-based atlas, summarizing results from an umbrella review (Köhler et al. 2018 see below in this table) that comprised results from a review article that we had included (Madsen et al. 2017, see Table S3-1).
2.	Harvey SB, Modini M, Joyce S, et al. Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. <i>Occup Environ Med</i> 2017; <b>74</b> (4): 301-10.	No meta-analysis.
3.	Köhler CA, Evangelou E, Stubbs B, et al. Mapping risk factors for depression across the lifespan: An umbrella review of evidence from meta-analyses and Mendelian randomization studies. <i>J Psychiatr Res</i> 2018; <b>103</b> : 189-207.	Results reported in another review article. This is an umbrella review that comprised results from a review article (Madsen et al. 2017) that we had included (see Table S3-1).
4.	Law PCF, Too LS, Butterworth P, Witt K, Reavley N, Milner AJ. A systematic review on the effect of work-related stressors on mental health of young workers. <i>Int Arch Occup Environ Health</i> 2020; <b>93</b> (5): 611-22.	No meta-analysis.
5.	Lee A, Myung SK, Cho JJ, Jung YJ, Yoon JL, Kim MY. Night shift work and risk of depression: Meta-analysis of observational studies. <i>J Korean Med Sci</i> 2017; <b>32</b> (7): 1091-6.	Majority of studies cross-sectional
6.	Milner A, Scovel AJ, King T, et al. Gendered working environments as a determinant of mental health inequalities: a systematic review of 27 studies. <i>Occup Environ Med</i> 2020.	Majority of studies cross-sectional.
7.	Milner A, Scovel AJ, King TL, Madsen I. Exposure to work stress and use of psychotropic medications: a systematic review and meta-analysis. <i>J Epidemiol Community Health</i> 2019; <b>73</b> (6): 569-76.	Other reasons for exclusion: Endpoint was use of psychotropic medication, either antidepressants, anxiolytics or psychotropic medication in general. Most studies on antidepressants were reported, together with other measures of depressive disorders, in another review that we had included (Mikkelsen et al. 2017, see Table S3-1). Studies on anxiolytics and psychotropic medication were very few and included cross-sectional studies. Thus, we judged that the review did not add substantial to the other included reviews.
8.	Milner A, Witt K, LaMontagne AD, Niedhammer I. Psychosocial job stressors and suicidality: a meta-analysis and systematic review. <i>Occup Environ Med</i> 2018; <b>75</b> (4): 245-53.	Majority of studies cross-sectional.
9.	Niedhammer I, Bertrais S, Witt K. Psychosocial work exposures and health outcomes: a meta-review of 72 literature reviews with meta-analysis. <i>Scand J Work Environ Health</i> 2021; <b>47</b> (7): 489-508.	Results reported in other review articles. This is a meta-review that covered several of the review articles that we included (Madsen et al. 2017, Rönnblad et al. 2019, Rudkjoebing et al. 2020, Rugulies et al. 2017, see Table S3-1).
10.	Nyberg A, Kecklund G, Hanson LM, Rajaleid K. Workplace violence and health in human service industries: a systematic review of prospective and longitudinal studies. <i>Occup Environ Med</i> 2021; <b>78</b> (2): 69-81.	No meta-analysis.
11.	Pacheco E, Bártolo A, Rodrigues F, Pereira A, Duarte JC, Silva CF. Impact of psychological aggression at the workplace on employees' health: A systematic review of personal outcomes and prevention strategies. <i>Psychol Rep</i> 2021; <b>124</b> (3): 929-76.	Majority of studies cross-sectional.
12.	Pachito DV, Pega F, Bakusic J, et al. The effect of exposure to long working hours on alcohol consumption, risky drinking and alcohol use disorder: A systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. <i>Environ Int</i> 2021; <b>146</b> : 106205.	Not mental disorder. No studies on alcohol disorder, only on alcohol consumption and risky drinking.
13.	Schneider A, Weigl M. Associations between psychosocial work factors and provider mental well-being in emergency departments: A systematic review. <i>PLoS One</i> 2018; <b>13</b> (6): e0197375.	No meta-analysis.
14.	Shields M, Dimov S, Kavanagh A, Milner A, Spittal MJ, King TL. How do employment conditions and psychosocial workplace exposures impact the mental health of young workers? A systematic review. <i>Soc Psychiatry Psychiatr Epidemiol</i> 2021; <b>56</b> (7): 1147-60.	No meta-analysis.
15.	Siegrist J, Wege N. Adverse psychosocial work environments and depression. A narrative review of selected theoretical models. <i>Front Psychiatry</i> 2020; <b>11</b> : 66.	No meta-analysis.
16.	Sterud T, Tynes T, Mehlum IS, et al. A systematic review of working conditions and occupational health among immigrants in Europe and Canada. <i>BMC Public Health</i> 2018; <b>18</b> (1): 770.	No meta-analysis.

ID	Reference	Reason for exclusion
17.	Torquati L, Mielke GI, Brown WJ, Burton NW, Kolbe-Alexander TL. Shift Work and Poor Mental Health: A Meta-Analysis of Longitudinal Studies. <i>Am J Public Health</i> 2019; <b>109</b> (11): e13-e20.	Not mental disorder, but poor mental health.
18.	Utzet M, Valero E, Mosquera I, Martin U. Employment precariousness and mental health, understanding a complex reality: a systematic review. <i>Int J Occup Med Environ Health</i> 2020; <b>33</b> (5): 569-98.	No meta-analysis.
19.	van der Molen HF, Nieuwenhuijsen K, Frings-Dresen MHW, de Groene G. Work-related psychosocial risk factors for stress-related mental disorders: an updated systematic review and meta-analysis. <i>BMJ Open</i> 2020; <b>10</b> (7): e034849.	Not mental disorder, but a mixture of mental health problems, reduced mental health and some studies with mental disorders in one meta-analysis.
20.	Virtanen M, Jokela M, Madsen IEH, et al. Long working hours and depressive symptoms: systematic review and meta-analysis of published studies and unpublished individual participant data. <i>Scand J Work Environ Health</i> 2018; <b>44</b> (3): 239-50.	Results reported in another review article. The results from this review were reported in a later review article, which also comprised additional articles, and we included this later and more comprehensive review (Rugulies et al. 2021, see Table S3-1).
21.	Wong K, Chan AHS, Ngan SC. The effect of long working hours and overtime on occupational health. A meta-analysis of evidence from 1998 to 2018. <i>Int J Environ Res Public Health</i> 2019; <b>16</b> (12).	Majority of studies cross-sectional.
22.	Yunitri N, Chu H, Kang XL, et al. Global prevalence and associated risk factors of posttraumatic stress disorder during COVID-19 pandemic: A meta-analysis. <i>Int J Nurs Stud</i> 2021; <b>126</b> : 104136.	Majority of studies cross-sectional.
23.	Zhao Y, Richardson A, Poyser C, Butterworth P, Strazdins L, Leach LS. Shift work and mental health: a systematic review and meta-analysis. <i>Int Arch Occup Environ Health</i> 2019; <b>92</b> (6): 763-93.	Not mental disorder. Most studies were not on mental disorders, but on mental health problems. The only meta-analysis provided in the paper combined studies examining mental disorders with studies on distress.
24.	Zimmermann M, Chong AK, Vechiu C, Papa A. Modifiable risk and protective factors for anxiety disorders among adults: A systematic review. <i>Psychiatry Res</i> 2020; <b>285</b> : 112705.	No meta-analysis.

**Table S3-3. Quality assessment of the seven included reviews**

Quality assessment question  Author, Year (Reference)	Q1: Population, exposure, outcome clearly described?	Q2: Appropriate inclusion criteria used?	Q3: Comprehensive search strategy?	Q4: Search strategy covered adequate number of years?	Q5: Level of evidence in primary studies described?	Q6: Methodological quality of primary studies appropriately assessed?	Q7: Quality of primary studies assessed (minimum 2 authors) and method of conflict resolution described?	Q8: Appropriate to combine findings across studies?	Q9: Appropriate methods used for combining or comparing results?	Q10: Do data support author's interpretation?	Total quality score
Duchaine et al. 2020 (24)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	<b>Strong (10)</b>
Madsen et al. 2017 (25)	yes (1)	yes (1)	no (0)	yes (1)	yes (1)	yes (1)	no (0)	yes (1)	yes (1)	yes (1)	<b>Strong (8)</b>
Mikkelsen et al. 2021 (26)	yes (1)	yes (1)	no (0)	yes (1)	yes (1)	no (0)	no (0)	yes (1)	yes (1)	yes (1)	<b>Moderate (7)</b>
Rönblad et al. 2019 (27)	yes (1)	yes (1)	no (0)	yes (1)	yes (1)	yes (1)	no (0)	yes (1)	yes (1)	yes (1)	<b>Strong (8)</b>
Rudkjoebing et al. 2020 (28)	no (0)	yes (1)	no (0)	yes (1)	yes (1)	no (0)	yes (1)	yes (1)	yes (1)	yes (1)	<b>Moderate (7)</b>
Rugulies et al. 2017 (29)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	<b>Strong (10)</b>
Rugulies et al. 2021 (30)	yes (1)	yes (1)	yes (1)	yes (1)	yes (1)	no (0)	yes (1)	yes (1)	yes (1)	yes (1)	<b>Strong (9)</b>

## Supplementary appendix S4: Discussion of the results from the overview of reviews

Of the 26 estimates depicted in **Figure 1**, 20 pertained to the outcome depressive disorders, whereas six estimates pertained to diagnosed mental disorders from sickness absence certificates that included but were not limited to depressive disorders. Thus, the evidence is largely restricted to depressive disorders, as there was a paucity of reviews on other mental disorders.

The vast majority of the pooled estimates (20 out of 26) indicated that exposures to adverse working conditions were associated with an increased risk of mental disorders. The magnitudes of these associations were in general small (13 estimates between 1.07 to 1.49) or moderate (six estimates between 1.53 to 1.77, these estimates were for job strain, effort-reward imbalance (in two reviews), relational justice, low rewards, and job insecurity). Only one estimate was above 2.00 (workplace bullying, 2.58), which is regarded as the threshold for “large magnitude of effect” according to GRADE and Navigation guide.<sup>33,34</sup>

After reviewing the extracted estimates from the reviews and after considering the factors for increasing and decreasing confidence in the estimates (see the manuscript for details), we conclude: There is clear evidence from prospective cohort studies that there is a statistical association between exposure to certain adverse working conditions and risk of depressive disorders (for other mental disorders, there is an insufficient number of studies) and it is unlikely that these associations are due to chance. These associations may indicate a causal effect of certain working conditions on the risk of depressive disorders; however, it cannot be ruled out that estimates are inflated or deflated due to biases.

To further improve the certainty of the evidence, we suggest seven areas for future research.

### **(i) Better theoretical framework**

Research on work stress models, such as job strain, effort-reward imbalance, and organisational justice, did not originate from an interest in workplace mental health but from an interest in other health outcomes, mostly cardiovascular disease.<sup>35</sup> Consequently, the conceptualization of work stress and long working hours are not well aligned with aetiological concepts discussed in psychiatry. This is different for exposures such as workplace bullying, workplace violence and threats, or workplace sexual harassment, which are potentially humiliating and traumatic self-esteem threatening experiences, fitting well with psychiatric research indicating that experiences of humiliation and severe threats to self-esteem play an important role in the aetiology of depressive disorders.<sup>36,37</sup> However, high quality epidemiological research on workplace bullying, violence and threats, and sexual harassment as causes of mental disorders is scarce. Thus, there is a need for elaborating more specific theories on the potential impact of working conditions on risk of mental disorders and to test these theories in high-quality studies.

### **(ii) Better exposure assessment strategies**

Most studies on working conditions and mental health used self-report to ascertain working conditions. This may cause reporting bias, because it is conceivable that workers' with prevalent mental health problems or subclinical mental disorders at baseline may both overestimate the adversity of working conditions at baseline and be at increased risk of developing a mental disorder at follow-up. To address this challenge, recent studies have averaged self-reported working conditions either at the job group level (job exposure matrix)<sup>38</sup> or at the work-unit level,<sup>39</sup> which will mitigate possible reporting bias. Other studies have measured working conditions by trained observers<sup>40</sup> or by using information from registers to approximate working conditions.<sup>41</sup> However, these alternative measures also have their own weaknesses. We suggest that combining different methods with different risks for over- and underestimation of the exposure-outcome association (triangulation) might be the most promising strategy assessing the contribution of the working conditions to the aetiology of mental disorders.<sup>42</sup>

### **(iii) Better understanding of biopsychosocial mechanisms**

Little is known about through which biological mechanisms environmental exposures, including working conditions, may affect individuals' mental health. Possible pathways that have been discussed include dysregulation of the hypothalamic-pituitary-adrenal (HPA) stress axis, inflammatory processes, disturbance of circadian rhythm, loss of neuroplasticity, and inhibition of neurogenesis.<sup>43-47</sup> A positron emission tomography (PET) study revealed that participants with high strain exhibited diminished activity in the anterior caudate, orbitofrontal cortex, VLPFC, insula, and midbrain, which might be related to the goal-directed action.<sup>48</sup> A similar study reported a negative correlation between job demand and cortical activity in the left DLPFC among women workers using near infrared spectroscopy (NIRS).<sup>49</sup> Poor working conditions may also reduce activities in preferential and other brain regions, which could be associated with risk of mental disorders, such as major depressive disorders. However, evidence is still conflicting.<sup>50</sup>

The quality of evidence is limited because the studies were cross-sectional and the exposures were measured by self-report. Better empirical data on these and other hypotheses are needed for a better understanding of how the environment, including working conditions, gets under the skin and into the brain of individuals.

#### **(iv) Innovative analytic methods and study designs**

The application of stronger analytic methods, such as the recent adoption of fixed effects regression, which inherently controls for unmeasured time-invariant confounding (such as early childhood experiences, personality traits, genetics) can strengthen causal inference in observational data.<sup>51</sup> Other recent innovations are the use of instrumental variable analyses<sup>52</sup> and of so-called “non-randomised pseudo trials” (or “emulated trials”) that analyse in observational data the association between an onset of an exposure with a subsequent change in mental health.<sup>53</sup>

#### **(v) Life-course perspective**

Mental disorders have a complex multifactorial aetiology likely involving various genetic, biological, psychological, and social risk factors that act over the life-course and that interact with each other.<sup>54-56</sup> When individuals enter the workforce, they are not tabula rasa but bring with them previous exposures and experiences that may interact with workplace exposures. Thus, working conditions are likely component causes in a multifactorial causal model of depressive disorders,<sup>57</sup> representing one part of the “exposome”, the totality of exposures individuals experience over the life course contributing to the risk of developing mental disorders.<sup>58</sup> Taking this appropriately into account, requires access to data about both working conditions and non-work environment exposures and to follow individuals from early in life, ideally before they start entering the workforce.<sup>38</sup> Further, the work environment itself is subject to changes due to for example new technologies and employees typically are exposed to different working conditions during their working life. This requires that we measure working conditions not only once, but repeatedly over an occupational life course.<sup>38</sup> This is particularly challenging in those occupational sectors, where the proportion of the workforce that works under precarious working conditions is increasing.<sup>59</sup>

#### **(vi) Exacerbation, relapse, and recurrence**

Mental disorders are chronic health conditions with a high rate of relapse and recurrence.<sup>60</sup> Work environment research has focused mainly on first onset of a mental disorders and little is known whether working conditions can contribute to the exacerbation of mental disorders, or to the development of a mental health problem (e.g., burnout or psychological distress) into a mental disorder (e.g., depressive or anxiety disorders). It is also unknown, whether working conditions can influence the chances of a relapse (revival of symptoms from an existing episode) or recurrence (new episode) of a mental disorder.

#### **(vii) Understanding the role of context**

The putative effect of the working conditions on risk of mental disorders may not only be modified by individual-level non-work-related risk factors but also by contextual factors. Some studies suggest that welfare state regime and national labour market policies modify the association between working conditions and mental health.<sup>61,62</sup> Societal structures may also condition, modify, and shape working conditions and their impact on workers' health.<sup>32</sup> Thus, a perspective that is restricted to individual-level risk factors of mental disorders, without a broader sociological perspective, may be too limited for fully understanding the relationship between the working conditions and mental health.<sup>63,64</sup> Cultural and geographical differences may also play a role. Common mental disorders have a lower prevalence in North and South East Asia and a higher prevalence in English-speaking countries.<sup>65</sup> The reasons for these differences are unknown, but it is conceivable that also the association between specific working conditions and risk of mental disorders may vary in different regions of the world. If this is the case, then research findings on the association between working conditions and risk of mental disorders that so far had mostly been generated from studies in Western and Northern Europe and North America should only with great caution, if at all, be generalised to other parts of the world.

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