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Title: The role of mental health on workplace productivity: a critical review of the literature

Running heading: The role of mental health on workplace productivity

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The role of mental health on workplace productivity: a critical review of the literature

Abstract

Background: Mental health disorders in the workplace have increasingly been recognised as a problem in most countries given their high economic burden. However, few reviews have examined the relationship between mental health and worker productivity.

Objective: To review the relationship between mental health and lost productivity and undertake a critical review of the published literature.

Methods: A critical review was undertaken to identify relevant studies published in MEDLINE and EconLit from January 1, 2008, to May 31, 2020, and to examine the type of data and methods employed, study findings and limitations, and existing gaps in the literature. Studies were critically appraised, namely whether they recognised and/or addressed endogeneity and unobserved heterogeneity, and a narrative synthesis of the existing evidence was undertaken.

Results: Thirty-eight (38) relevant studies were found. There was clear evidence that poor mental health (mostly measured as depression and/or anxiety) was associated with lost productivity (i.e., absenteeism and presenteeism). However, only the most common mental disorders were typically examined. Studies employed questionnaires/surveys and administrative data and regression analysis. Few studies used longitudinal data, controlled for unobserved heterogeneity or addressed endogeneity; therefore, few studies were considered high quality.

Conclusion: Despite consistent findings, more high quality, longitudinal and causal inference studies are needed to provide clear policy recommendations. Moreover, future research should seek to understand how working conditions and work arrangements as well as workplace policies impact presenteeism.

Key points for decision makers

- Despite clear evidence that poor mental health is associated with lost productivity at work, more evidence is required to understand the extent to which mental illness decreases productivity and the mechanisms through which this occurs in order to provide appropriate policy responses.
- A better understanding of the relationship between mental illness and worker productivity is needed to understand the trade-offs between presenteeism and absenteeism.
- Workplace policies that limit and help workers manage job stress can help improve workers' productivity.

Keywords: mental health, workplace, productivity, absenteeism, presenteeism, short- and long-term disability, job loss

JEL codes: I10, J24

1. Introduction

Mental health disorders in the workplace, such as depression and anxiety, have increasingly been recognised as a problem in most countries. Using a human capital approach, the global economic burden of mental illness was estimated to be USD\$2.5 trillion in 2010 increasing to USD\$6.1 trillion in 2030; most of this burden was due to lost productivity, defined as absenteeism and presenteeism.¹ Workplaces that promote good mental health and support individuals with mental illnesses are more likely to reduce absenteeism (i.e., decreased number of days away from work) and presenteeism (i.e., diminished productivity while at work), and thus increase worker productivity.² Burton et al. (2008) provided a review of the association between mental health and worker productivity.³ The authors found that depressive disorders were the most common mental health disorder among most workforces and that most studies examined found a positive association between the presence of mental health disorders and absenteeism (particularly short-term disability absences). They also found that workplace policies, which provide employees with access to evidence-based care result in reduced absenteeism, disability and lost productivity.³

However, this review is now outdated. Prevalence rates for common mental disorders have increased,⁴ while workplaces have also responded with attempts to reduce stigma and the potential economic impact,⁵ necessitating the need for an updated assessment of the evidence. Furthermore, given that most of the global economic burden of mental illness is due to lost productivity,¹ it is important to have a good understanding of the existing literature on this outcome. While the previous review focused on the prevalence of certain mental health conditions and the available interventions and workplace policies, this review focused on the measures of lost productivity and the instruments used, as well as the data and methods

employed, which the previous review did not examine in depth. Thus, the objectives of this paper were to update the Burton et al. (2008) review on the association between mental health and lost productivity, and undertake a critical review of the literature that has been published since then, specifically how researchers have studied this relationship, the type of data and databases they have employed, the methods they have used, their findings, and the existing gaps in the literature.

2. Methods

We undertook a critical review, i.e., a review, which presents, analyses and synthesizes evidence from diverse sources by extensively searching the literature and critically evaluating its quality,⁶ ultimately identifying the most significant papers in the field.¹ We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement⁷ to guide our analysis. Our review focused on all studies published since 2008, which examined the relationship between mental health and workplace-related productivity among working age adults. We used the population, intervention, control, outcomes, and study design (known as PICOS) criteria to guide the development of the search strategy.

2.1. Eligibility criteria

The populations of interest comprised working age adults (18-65 years old). Studies focusing solely on volunteers and/or caregivers (i.e., unpaid workers) were excluded. The intervention(s), or rather more appropriately the exposure(s), had to be a diagnosis of any mental disorder/illness or self-reported mental health problem(s). Any studies that examined substance

¹ This type of review differs from a systematic review, which seeks to systematically search for, appraise and synthesize existing evidence, often following existing guidelines on the conduct of a review.

use and/or physical health in addition to mental health were included if results were reported separately for mental health-related outcomes. The control or comparator group, where applicable, included working age individuals without a mental disorder/illness or mental health problems. The outcome(s) included lost workplace productivity measured by absenteeism, presenteesim, sick leave, short- and/or long-term disability, or job loss. Studies that examined productivity of home-related activities (e.g., housework) were excluded. Studies with an observational study design and/or regression analysis were included; randomised control trials, cost-of-illness studies and economic evaluations were excluded (the first two were only included *if* they examined the relationship between mental health and lost productivity). Only original studies were considered; however, relevant reviews were retained for reference checking to find relevant studies, which may not have been captured by the search strategy.

2.2. Search strategy

We searched literature published in English from January 1, 2008, to May 31, 2020. Structured searches were done in MEDLINE and EconLit to capture the most relevant literature published in the medical and economics fields, respectively. We also undertook relevant searches in Google and on specific websites of interest (e.g., UK Parliament Hansard, the National Institute for Health and Care Excellence, the Centre for Mental Health, the Health Foundation, the Institute for Fiscal Studies and the King's Fund) and a hand search of the references of key papers.⁸ Search terms or strings were developed on the basis of four concepts: population or workplace, intervention/exposure (i.e., presence of mental disorder/illness), work-related outcomes, and study design (see **Table 1**).

2.3 Study selection

After duplicate records were removed, one reviewer (LB) screened all titles and abstracts while additional reviewers (CdO and RJ) were brought in for discussion, if/where necessary. Articles were excluded either because they did not examine the relationship between mental health and lost productivity (e.g., some cost-of-illness studies) or were mainly focused on physical health. Subsequently, all relevant full text articles were retrieved and screened by one reviewer (LB) to confirm eligibility; additional reviewers (MS, RJ or CdO) were brought in, if/where necessary.

2.4. Data extraction

Two reviewers (LB and MS) undertook the data extraction, and an additional reviewer (RJ or CdO) was assigned to resolve any disagreements. The research team developed a data extraction form, based on the Cochrane good practice data extraction form, which included study information (author(s), year of publication), country (where the study was published or conducted), aims of study, study design (cross-sectional, longitudinal), data source(s) (i.e., database(s), surveys/questionnaires), study population (sample size, age range), mental disorder(s) examined, workplace outcome examined (absenteeism, presenteeism, short-term disability, long-term disability, job loss, other), methods employed (statistical analysis, regression model employed), and results/key findings.

2.5 Quality assessment

We reviewed the methods employed in the studies to assess their quality and robustness, drawing loosely on the Newcastle-Ottawa Scale, a risk of bias assessment tool for observational studies.⁹ We paid particular attention to whether studies were able to move beyond simple associations and attempted to address causal inference, where necessary, and whether they took account of endogeneity (i.e., cases where the explained variable and the explanatory

variable are determined simultaneously) and/or unobserved heterogeneity (i.e., cases where the presence of unexplained (observed) differences between individuals are associated with the (observed) variables of interest), which are common issues when examining the relationship between mental health and lost productivity. All studies that recognised and/or accounted for these issues were considered high-quality. We also examined the type of data/databases employed (i.e., cross-sectional or longitudinal data and representative, population-based samples), findings, and limitations (and the extent to which these impacted the findings), which were also considered when determining the quality of a study.

2.6. Data synthesis

Given the heterogeneity of studies examined, undertaking a meta-analysis was not possible. Therefore, we undertook a narrative synthesis of the relevant literature, where we synthesised the existing evidence by mental disorder/illness and workplace outcome (absenteeism, presenteeism, sick leave, short- and long-term disability, or job loss), if/where appropriate.

3. Results

3.1. Study selection

After all citations were merged and duplicates removed, our search produced 648 unique records, of which 89 full texts were assessed; four studies were obtained from other sources (e.g., Google searches). Ultimately, 38 studies were included in the final review¹⁰⁻⁴⁷ (see **Figure 1**) and relevant data were extracted (see **Table 2** and **Table A1** in the appendix for more details).

3.2. Overview of studies

All studies focused on individuals typically between the ages of 18 and 64/65 years old. Some studies (n=5) examined individuals 20 or 25 years and older,^{11,12,16,28,38} to account for younger individuals who might still be in school and thus not working, while other studies had different lower and upper age limits ((e.g., age 15^{25,47} and age 60,^{11,38} respectively). Most studies were from the USA (n=10; 26%) and the Netherlands (n=6; 16%); this result is line with the findings from a review of economic evaluations of workplace mental health interventions.⁴⁸ The remaining studies were from Australia (n=4), Japan (n=4), South Korea (n=3), multiple countries (n=4), Brazil (n=1), Colombia (n=1), Denmark (n=1), Finland (n=1), Norway (n=1), Singapore (n=1), and the United Kingdom (n=1). Many studies did not specify the setting or industry or state the size of the firm where the study was undertaken (also found elsewhere⁴⁸); consequently, this information was not included in the data extraction form.

3.3. Measures and instruments/tools used

3.3.1. Mental health

Most studies (n=16) examined depression/depressive symptoms, major depressive disorder or other mood disorders (see **Figure 2**). Two studies examined anxiety and five studied both anxiety and depression. A smaller number of studies examined other disorders – three studies examined ADHD, two studies focused on bipolar disorder, one examined panic disorder, one studied binge eating disorder, and one looked at other disorders including mental disorders (depressive symptoms and cognitive function). Three studies looked at mental health broadly speaking (two studies examined poor mental health and another studied common mental disorders). Finally, four studies examined multiple mental disorders (e.g., depression, bipolar disorder, anxiety disorders, emotional disorders, substance use disorders, ADHD). Some studies used a binary indicator for the presence/absence of a mental disorder/poor mental health,

while other analyses used different aggregate measures of mental illness or psychological distress, based on the number of recorded symptoms.

A variety of instruments/tools were used to measure mental health, depending on the disorder. Depression was measured using the Kessler Psychological Distress Scale (K6 scale),⁴⁹ Patient Health Questionnaire (PHQ-9) depression scale,⁵⁰ Center for Epidemiologic Studies Depression Scale (CES-D),⁵¹ Short General Health Questionnaire (GHQ-12),⁵² Major Depression Inventory (MDI),⁵³ Hamilton Rating Scale for Depression (HAM-D),⁵⁴ and Mental Health Inventory (MHI-5).⁵⁵ In studies that examined both anxiety and depression (n=2), the authors used either the Hospital Anxiety and Depression Scale (HADS)⁵⁶ or the Composite International Diagnostic Interview (CIDI).⁵⁷ In one study,⁴² severity of anxiety and depressive symptoms was assessed using the Beck Anxiety Inventory⁵⁸ and the Inventory for Depressive Symptomatology questionnaire,⁵⁹ respectively. In another study,³³ mood disorder was measured using the Mood Disorder Questionnaire (MDQ).⁶⁰ In one study,⁴¹ ADHD was assessed using the WHO World Mental Health (WMH) survey,⁶¹ in another,³⁵ it was assessed using the WHO Adult ADHD Self-Report Scale.⁶² Panic disorders were measured using the Panic Disorder Severity Scale⁶³ in one study.¹⁶

3.3.2. Lost productivity

Nineteen studies examined both absenteeism and presenteeism, eight studies examined absenteeism only, two studies examined presenteeism only, and nine examined other or several workplace outcomes, such as employment, absenteeism, presenteeism, workplace accidents/injuries, short- and/or long-term disability, activity impairment and/or job loss (see **Figure 3**).

Five studies used the Work Productivity and Activity Impairment (WPAI) questionnaire⁶⁴ (Beck et al., 2011;²⁷ Jain et al., 2013;³⁶ Able et al., 2014;³⁰ Asami et al., 2015;³¹ Ling et al., 2017⁴⁴); three used the WHO's Health and Work Performance Questionnaire (HWP)⁶⁵ (Hjarsbech et al., 2010;¹⁸ Woo et al., 2011;³⁸ Park et al., 2014¹⁶) to determine absenteeism and presenteeism. A recent systematic review also found that that the WPAI was most frequently applied in economic evaluations and validation studies to measure lost productivity.⁶⁶ Two studies^{12,20} used the Work Limitations Questionnaire.⁶⁷ Other studies used a variety of different instruments to measure lost productivity, such as the Trimbos/iMTA questionnaire for Costs Associated with Psychiatric illness (TiC-P)⁶⁸ (Bokma et al., 2017²⁶), the Short-Form Health and Labour Questionnaire⁶⁹ (Bouwman et al., 2014⁴⁵), the WHO Disability Assessment Schedule (WHO-DAS)⁷⁰ (de Graaf et al., 2012²³) and the Endicott Work Productivity Scale⁷¹ (McMorris et al., 2010³³). One study⁴³ made use of four work performance measures to examine lost productivity: WPAI,⁶⁴ Work Limitations Questionnaire (WLQ),⁶⁶ Endicott Work Productivity Scale (EWPS)⁷¹ and Functional Status Questionnaire Work Performance Scale (WPS).⁷²

3.4. Data sources and methods

3.4.1. Data

Most studies (n=20) employed data collected through surveys/questionnaires, though some used publicly available datasets, such as the Medical Expenditure Panel Survey,²⁹ the National Comorbidity Survey Replication²⁸ and the National Latino and Asian American Study,²⁸ the US National Health and Wellness Survey,⁴⁴ the Household, Income and Labour Dynamics in Australia survey,^{25,47} and the Singapore Mental Health Study.²⁴ One study used administrative claims data.³² Three studies made use of linked data, such as Hjarsbech et al., 2011,¹⁸ which

linked questionnaires to the Danish National Register of Social Transfer Payments, Erickson et al., 2009,⁴³ which utilised questionnaires linked to medical records, and Mauramo et al., 2018,³⁴ which used survey data from the Helsinki Health Study linked to employer's register data on sickness absence. Only one study employed trial data.⁴⁵ Most studies (n=29; 76%) employed cross-sectional data; few used longitudinal data (n=9; 24%).

3.4.2. Methods

Several studies (n=8) used regression analysis to examine the relationship between mental health and lost productivity, namely linear regression^{11,17} and logistic regression models.^{25,29,42,45} Two studies employed two-part models, where the first part examined the probability/odds of workers experiencing absenteeism, while the second part modeled the number of hours of absenteeism¹⁰ or the number of work days missed.²⁹ One paper employed Poisson regressions to model the rate of work-lost days (absenteeism) and work-cut days (presenteeism).³⁴ Another study computed Kaplan–Meier survival curves to estimate the mean and median duration of sickness absence due to depressive symptoms,⁴⁰ and one estimated a Cox's proportional hazards model to analyse whether and to what extent depressive symptoms at baseline predicted time to onset of first long-term sickness absence during the one-year follow up period.¹⁸ Only one study employed instrumental variables to address the potential endogeneity of the mental illness variable employed²⁸ and four employed longitudinal data models.^{13,20,25,47}

3.5. Evidence synthesis

Almost all studies (n=36) found a positive (and, many times, a strong) association between the presence of mental illness/disorders or poor mental health and productivity loss measured by absenteeism and/or presenteeism. Nevertheless, there were a few exceptions – one study

found that mood disorders were associated with decreased presenteeism (i.e., work performance) but found no significant relationship between mood disorders and absenteeism.¹¹

Another study found that individuals with binge eating disorders reported greater levels of presenteeism and lost productivity than those without but found no effect for absenteeism.⁴⁴

Many studies (n=6) on depression examined both absenteeism and presenteeism where the presence of the former was positively associated with the latter (as was the case for studies, which examined only absenteeism and only presenteeism) and the latter was higher among those with higher severity of depression. These findings held in studies examining major depressive disorder and bipolar disorder (though one study found that symptoms of mania or hypomania were not significantly associated with absenteeism).¹⁴ Studies examining depression and anxiety (and anxiety alone, including panic disorder) generally examined both absenteeism and presenteeism and found that these disorders were significantly associated with lost productivity. One study found that workers with binge eating disorder reported greater levels of presenteeism than those without but no differences in absenteeism. All studies on ADHD (n=3) examined both absenteeism and presenteeism and found ADHD was associated with more days of missed work and poor work performance. Studies looking at mental health (broadly defined) typically examined absenteeism only, finding a positive relationship between both, though the magnitude of the effect was found to be modest in one study.⁴⁷ Studies examining multiple disorders (n=4) also examined both absenteeism and presenteeism. Overall, having a mental disorder was positively associated with lost productivity; however, one study found no significant relationship between mood disorders and alcohol use/dependence and absenteeism.¹¹

Many studies (n=6) found that higher severity of the disorder or co-occurring mental health conditions was associated with greater productivity loss. For example, Knudsen et al. (2013) found that while comorbid anxiety and depression and anxiety alone were significant risk factors for absenteeism, depression alone was not.³⁷

Some studies examined outcomes separately for men and women (n=5) or examined specific groups (n=1). For example, Ammerman et al. (2015) examined high-risk, low-income mothers with major depression and found that depression significantly increased the likelihood of absenteeism (i.e., missing workdays) among this group.²⁹ However, beyond gender, studies did not report on differences by ethnicity/race and/or age.

Overall, we found that the literature on this topic continues to examine the most common mental disorders (e.g., depression and anxiety) using similar data sources and analysis techniques as the Burton et al. (2008) review (see **Table 3**). However, more recent literature shows that the positive relationship between the presence of mental disorders and lost productivity may not hold in all instances.

4. Discussion

The goal of this review was to provide a comprehensive overview and critical assessment of the most recent literature examining the relationship between mental health and workplace productivity, with a particular focus on data and methods employed. It provides clear evidence that poor mental health is associated with lost productivity, defined as increased absenteeism (i.e., more missed days from work) and increased presenteeism (i.e., decreased productivity at work). However, overall, only 3 studies were of high quality.^{25,28,47} Studies with greater rigour

and more robust methods, which accounted for unobserved heterogeneity for example, found a similar positive relationship but a smaller effect size.^{25,47}

Other reviews have also found large significant associations between measures of mental health and lost productivity, such as absenteeism.^{3,73-75} For example, Burton et al. (2008) found that depressive disorders were the most common mental health disorder among most workers, with many studies showing a positive association between the presence of mental health conditions and absenteeism, particularly short-term disability absences.³ However, we found that studies employing superior methodological study design have shown the strength of the observed association may be smaller than previously thought.

Overall, our findings are in line with those from other reviews⁷³⁻⁷⁵ and the Burton et al. study. We too found that the most common disorder examined was depression, followed by depression and anxiety, the most studied workplace outcomes were both absenteeism and presenteeism, and that there was an association between mental disorders and both absenteeism and presenteeism. We found that studies employed a variety of data sources, from data collected from surveys/questionnaires to existing surveys and administrative data. Regression analysis was commonly used to examine the relationship between mental health and lost productivity, though there were some studies where the most appropriate regression model was not used given the outcome examined (e.g., linear regression models were used regardless of the type of outcome examined).

Some studies employed small sample sizes,^{20,43} which are not representative of the broader population and can thus impact the generalizability of findings, and other studies that did use

nationally representative population samples employed cross-sectional designs,^{11,42,46} which can limit causal inference. Therefore, the vast majority did not examine the causal effect of mental health on lost productivity, but rather only the association between the two. A notable exception was Banerjee et al., which examined the potential endogeneity of the mental illness variable used.²⁸ Moreover, few studies employed longitudinal data, which can help account for unobserved heterogeneity (that may be correlated with both mental health and lost productivity) and minimise the potential for reverse causality and omitted variable bias; Wooden et al. (2016)⁴⁷ and Bubonya et al. (2017)²⁵ were notable exceptions. Wooden et al. found that the association between poor mental health and the number of annual paid sickness absence days was much smaller once they accounted for unobserved heterogeneity and focused on within-person differences.⁴⁷ For example, the incidence rate ratios for the number of sickness absence days for employed women and men experiencing severe depressive symptoms were 1.31 and 1.38 in the negative binomial regression models but dropped to 1.10 and 1.13, respectively, once the authors controlled for unobserved heterogeneity through the inclusion of correlated random effects. Thus, it may be that previous research has overstated the magnitude of the association between poor mental health and lost productivity. More studies with rigorous causal inference are required to help strengthen the ability to make informed policy recommendations.

Few studies explored the factors that might explain absenteeism and/or presenteeism due to mental health. Again, the study by Bubonya et al. (2017) was a notable exception,²⁵ providing several important insights on the relationship between mental health and lost productivity. According to the authors, initiatives that limit and help workers manage job stress seem to be the most promising avenue for improving workers' productivity. Furthermore, the authors found

that presenteeism rates among workers with poor mental health were relatively insensitive to work environments, in line with other research from the UK;⁷⁶ consequently, they suggested that developing institutional arrangements that specifically target the productivity of those experiencing mental ill health may prove challenging. These findings are particularly important in the context of the COVID-19 pandemic due to changes in work arrangements and workplaces (e.g., working from home while trying to balance work with home and care responsibilities, hybrid working arrangements, and ensuring workplaces have COVID-19 secure measures in place). This work will be of particular interest to employers and decision makers looking to improve worker productivity.

Most literature examined either depression or anxiety or both, the most common mental disorders. Few studies examined mental disorders, such as ADHD, bipolar disorder, and eating disorders, and no studies examined schizophrenia and other psychotic disorders, personality disorder, or suicidal/self-harm behaviour. More work is needed on these mental disorders, which, although less prevalent and thus less studied, are potentially more work disabling (despite already low employment rates for individuals with these conditions).^{77,78} Other research suggests there are important gender differences.^{25,28} For example, Bubonya et al. (2017) found that increased job control can help reduce absenteeism for women with good mental health, though not for women in poor mental health.²⁵ Banerjee et al. (2017) found that the impact of poor mental health on the likelihood of being employed and in the labour force is higher for men.²⁸ Future research should ensure that gender differences, as well as other differences (e.g. age, industry, job conditions), are examined to ensure tailored policies are developed and implemented.

There is also a need to better understand the extent to which mental illness decreases productivity at work and the mechanisms through which this occurs, as this could help inform the role of employment policy and practices to minimise presenteeism.²⁵ Some research suggests that conducive working conditions, such as part-time employment and having autonomy over work tasks, can help mitigate the negative impact of mental health on presenteeism.⁷⁶ Alongside this, it is important to learn more about the dynamics of the relationship between mental illness and worker productivity to understand the trade-offs between presenteeism and absenteeism.²⁵ For example, it would be helpful to understand whether policies that incentivise workers with mental ill health to take time off improve overall productivity by reducing presenteeism. None of the studies in this review explored this trade-off. Finally, more rigorous research on this topic would help achieve a better understanding of the overall economic impact of mental disorders.

This review is not without limitations. It only included studies obtained from a few select databases and did not include grey literature, and only one reviewer screened the titles and abstracts (though the purpose was not to undertake a systematic review); however, it examined papers and reports from select websites of interest. Furthermore, this review only focused on the relationship between mental health and lost productivity. Although lost productivity is an important labour market outcome, there are other outcomes that mental health can impact such as labour force participation, wages/earnings, and part-time versus full time employment. Finally, this review only included studies published in English and therefore may have missed other relevant studies. Nonetheless, this review has several strengths. It provides an updated review on this topic, thus addressing a critical gap in the literature, and examined the type of

data and databases employed, the methods used, and the existing gaps in the literature, thus providing a more comprehensive overview of the research done to date.

5. Conclusion

This review found clear evidence that poor mental health, typically measured as depression and/or anxiety, was associated with lost productivity, i.e., increased absenteeism and presenteeism. Most studies used survey and administrative data and regression analysis. Few studies employed longitudinal data, and most studies that used cross-sectional data did not account for endogeneity. Despite consistent findings across studies, more high-quality studies are needed on this topic, namely those that account for endogeneity and unobserved heterogeneity. Furthermore, more work is needed to understand the extent to which mental illness decreases productivity at work and the mechanisms through which this occurs, as well as a better understanding of the dynamics of the relationship between mental illness and worker productivity to understand the trade-offs between presenteeism and absenteeism. For example, future research should seek to understand how working conditions and work arrangements as well as workplace policies (e.g., vacation time and leaves of absence) impact presenteeism.

Table 1. Concepts and search terms used to identify relevant studies

Concept	Search terms
Population	work, workplace, worker, labourer/laborer, employment, employee, occupation
Intervention/exposure	mental health, mental illness, mental wellbeing, mental hygiene, burnout, schizophrenia, schizoaffective disorder, psychotic disorders, psychosis, bipolar disorder, mania, depression, unipolar disorder, mood disorder, dysthymia, anxiety, stress, phobia, panic disorder, neurosis, anorexia nervosa, bulimia nervosa, binge eating disorder, eating disorder, personality disorder, obsessive compulsive disorder, suicide, suicide ideation, self-harm, adult ADHD
Outcome	productivity, absenteeism, presenteeism, sick leave, short-term disability, long-term disability
Study design	observational, regression

Legend: ADHD – attention deficit hyperactivity disorder

Table 2. Overview of included studies

Study	Country	Study design	Data source	Study population	Mental disorder(s)	Workplace outcome(s)	Methods	Key finding(s)
Asami et al. (2015)	Japan	Cross-sectional	National Health and Wellness Survey	n = 17,820; 18 years and over	Depression	Absenteeism, presenteeism, overall work productivity loss and activity impairment	Mental health measurement: Patient Health Questionnaire (PHQ-9) Workplace outcome measurement: Work Productivity and Activity Impairment (WPAI) questionnaire. Analysis: generalized linear regression models (negative binomial distribution and log-link function)	Among the undiagnosed, high severity workers had greater overall work impairment than low severity workers. Significant interactions between diagnosis and severity indicated greater impairments among undiagnosed than among diagnosed respondents, except on absenteeism.
Beck et al. (2011)	USA	Cross-sectional	study questionnaire/survey	n = 771; older than 18 years old	Depression	Absenteeism and presenteeism	Mental health measurement: Patient Health Questionnaire (PHQ-9) Workplace outcome measurement: Work Productivity and Activity Impairment (WPAI) questionnaire, self-report Analysis: generalized linear regression models	Depression symptom severity was strongly associated with productivity loss (i.e., absenteeism [work loss] and presenteeism [productivity impairment]).
Evans-Lacko and Knapp (2016)	Multiple countries (Brazil, Canada, China, Japan, South Korea, Mexico, South Africa and USA)	Cross-sectional	Global Impact of Depression in the Workplace in Europe Audit Survey	n = 8,061; 18-64 years old	Depression	Absenteeism and presenteeism	Mental health measurement: self-report Workplace outcome measurement: WHO Health and Work Performance Questionnaire (HPQ) Analysis: generalized linear regression models; generalized estimating equations with robust variance estimates to	Depression was positively associated with absenteeism and presenteeism across a diverse set of countries, in terms of both culture and GDP.

							model within-country correlations	
Jain et al. (2013)	USA	Cross-sectional	study questionnaire/survey	n = 1,051; 18 years and over	Depression	Absenteeism and presenteeism	Mental health measurement: Patient Health Questionnaire (PHQ-9) Workplace outcome measurement: Health and Work Performance Questionnaire (HPQ) and Work Productivity and Activity Impairment Questionnaire (WPAI) Analysis: trend test based on an analysis of covariance	Absenteeism and presenteeism were positively associated with severity of depression.
Johnston et al. (2019)	Australia	Cross-sectional	study questionnaire/survey	n = 4,953; over 18 years old	Depressive symptoms	Absenteeism and presenteeism	Mental health measurement: Patient Health Questionnaire (PHQ-9) Workplace outcome measurement: WHO Health and Work Performance Questionnaire (HPQ) Analysis: linear regression model	Depression was positively related to presenteeism and absenteeism.
Suzuki et al. (2015)	Japan	Longitudinal	study questionnaire/survey	n = 1,831; 21-65 years old	Depression	Absenteeism and presenteeism	Mental health measurement: Kessler Psychological Distress Scale (K6) Workplace outcome measurement: World Health Organisation Health and Work Performance Questionnaire (WHO-HPQ).	Workers with higher sickness presenteeism had higher rates of depression and sickness absence due to mental disease.

							Analysis: multiple logistic regression model	
Curkendall et al. (2010)	USA	Cross-sectional	administrative claims data	n = 22,427; age range not specified	Depression	Absenteeism, short-term disability	Mental health measurement: dispensed at least one prescription for an antidepressant medication and had an ICD-9-CM diagnosis of depression Workplace outcome measurement: Health and Productivity Management databases Analysis: generalized linear regression models (gamma distribution and a log link), two-part regression models	Workers with depression were more likely to use short-term disability leave and have higher absenteeism (even after receiving antidepressant treatment) than those without depression.
Hjarsbech et al. (2011)	Denmark	Cross-sectional	study questionnaire/survey linked to register data	n = 6,985 (females only); no age range specified	Depression	Absenteeism	Mental health measurement: Major Depression Inventory (MDI) Workplace outcome measurement: Danish National Register of Social Transfer Payments Analysis: Cox's proportional hazards regression model	Reduced psychological health was associated with absenteeism.
Koopmans et al. (2008)	The Netherlands	Cross-sectional	firm data	n = 9,450; age range not specified	Depression	Absenteeism	Mental health measurement: occupational health department's registration system Workplace outcome measurement: occupational physician records Analysis: Kaplan-Meier survival curves	Workers with depressive symptoms had longer episodes of absenteeism.

Lamichhanne et al. (2017)	South Korea	Cross-sectional	study questionnaire/survey	n = 2,349; no age range specified	Depression, depressive symptoms	Absenteeism	Mental health measurement: Center for Epidemiologic Studies Depression Scale (CES-D) Workplace outcome measurement: self-report Analysis: multivariable logistic regression model	Workers with depressive symptoms (CES-D ≥ 16) were found to have higher odds of absenteeism.
Harvey et al. (2011)	United Kingdom	Cross-sectional	study questionnaire/survey	n = 1,161; age range not specified	Depression	Presenteeism	Mental health measurement: Patient Health Questionnaire depression scale (PHQ-9) Workplace outcome measurement: company records Analysis univariate linear regression model, multivariable linear regression model	Depressive symptoms were positively related to presenteeism (i.e., poorer work performance).
Ammerman et al. (2016)	USA	Cross-sectional	Medical Expenditure Panel Survey	n = 20,531 (females only); 18-35 years old	Major depressive disorder	Absenteeism	Mental health measurement: International Classification of Diseases, 9th Revision (ICD-9) diagnosis code of 296 or 311 Workplace outcome measurement: self-report Analysis: two-part regression models	Depression significantly increased the likelihood of absenteeism among high-risk, low-income mothers.
Buist-Bouwman et al. (2008)	Multiple countries (Belgium, France, Germany, Italy, the Netherlands and Spain)	Cross-sectional	European Study of the Epidemiology of Mental Disorders data	n = 5,565; 18 years old and older	Major depressive episode	Absenteeism and presenteeism	Mental health measurement: Composite International Diagnostic Interview (CIDI) Workplace outcome measurement: European Study of the Epidemiology of Mental Disorders-WHO Disability Assessment Schedule (ESEMeD-WHODAS) Analysis: structural equation models	Depression had a strong negative effect on role functioning (i.e., absenteeism and presenteeism) mediated by cognition and feelings of embarrassment.

Hees et al. (2013)	The Netherlands	Longitudinal	study questionnaire/survey	n = 117; 18-65 years old	Major depressive disorder	Absenteeism and presenteeism	Mental health measurement: Hamilton Rating Scale for Depression (HRSD) Workplace outcome measurement: self-report diaries and Work Limitations Questionnaire (WLQ) Analysis: regression models, including autoregressive regression models	Higher level of depressive symptoms was associated with a decrease in work productivity (i.e., presenteeism), and an increase in absenteeism and work limitations.
Uribe et al. (2017)	Colombia	Cross-sectional	study questionnaire/survey	n = 107; 18-65 years old	Major depressive disorder	Absenteeism and presenteeism	Mental health measurement: Diagnostic and Statistical Manual of Mental Disorders (4th ed., Text Revision) and the International Classification of Diseases, Tenth Revision Workplace outcome measurement: World Health Organisation's Health and Work Performance Questionnaire (HPQ) Analysis: two-part regression models	Workers who rated their mental health favourably had a lower probability of absenteeism and fewer hours per month of presenteeism.
Woo et al. (2011)	South Korea	Longitudinal	study questionnaire/survey	n = 193; 20-60 years old	Major depressive disorder	Absenteeism and presenteeism	Mental health measurement: Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, Hamilton Rating Scales for Depression (HAM-D) Workplace outcome measurement: Health and Work Performance Questionnaire (HPQ) Analysis: T-tests, chi-square tests, and analysis of variance tests	Workers with major depressive disorder had significantly higher absenteeism and presenteeism than those without medical psychiatric illness. After 8 weeks of treatment, absenteeism and clinical symptoms of depression were significantly reduced and associated with significant improvement in self-rated job performance.

Simon et al. (2008)	USA	Longitudinal	study questionnaire/survey	n = 412; 64 years old and under	Bipolar disorder	Absenteeism, employment	Mental health measurement: Structured Clinical Interview for DSM-IV (SCID) Workplace outcome measurement: self-report Analysis: generalized estimating equations (log link), generalised estimating equations (linear link)	Major depression was strongly and consistently associated with decreased probability of employment and absenteeism; symptoms of mania or hypomania were not significantly associated with employment or absenteeism.
McMorris et al. (2010)	USA	Cross-sectional	study questionnaire/survey	n = 417; 18-64 years old	Bipolar disorder	Absenteeism, workplace productivity, short- and long-term disability	Mental health measurement: Mood Disorder Questionnaire (MCQ) Workplace outcome measurement: Endicott Work Productivity Scale (EWPS) Analysis: linear regression model	Workers with bipolar disorder were more likely to report lower levels of workplace productivity, more likely to miss work, have worked reduced hours due to medical or mental health issues, and receive disability payments.
Banerjee et al. (2017)	USA	Cross-sectional	National Comorbidity Survey Replication and the National Latino and Asian American Study	n = 7,566; 25-64 years old	Major depressive episode, anxiety	Absenteeism, employment, labour force participation, number of weeks worked	Mental health measurement: self-report Workplace outcome measurement: self-report Analysis: multiple Indicator and Multiple Cause model (i.e., structural equation regression model), covariance instruments (to address endogeneity)	Mental illness adversely affects employment and labour force participation and reduces the number of weeks worked and increases work absenteeism.
Knudsen et al. (2013)	Norway	Longitudinal	Hordaland Health Study data linked to state registry data	n = 13,436; age range not specified	Depression, anxiety	Absenteeism	Mental health measurement: Hospital Anxiety and Depression Scale (HADS) Workplace outcome measurement: Norwegian registries Analysis: Cox regression, multinomial logistic regression model	Comorbid anxiety and depression, and anxiety only were significant risk factors for absenteeism, while depression only was not. Anxiety and depression were stronger predictors for longer duration and with more frequent recurrence of absenteeism.

Bokma et al. (2017)	The Netherlands	Cross-sectional	Netherlands Study of Depression and Anxiety	n = 1,462; 18-65 years old	Depressive disorders, anxiety	Absenteeism, presenteeism and disability	Mental health measurement: Composite International Diagnostic Interview (CIDI) Workplace outcome measurement: WHO-Disability Assessment Schedule (WHO-DAS II), Trimbos/iMTA questionnaire for Costs Associated with Psychiatric illness (TiC-P) Analysis: multivariate regression model	Anxiety and depressive disorders were associated with worse absenteeism and presenteeism outcomes and disability (compared to chronic somatic diseases).
Bouwman et al. (2014)	The Netherlands	Cross-sectional	randomised control trial data	n = 425; working population (age range not specified)	Depression, anxiety	Absenteeism and presenteeism	Mental health measurement: Composite International Diagnostic Interview (CIDI) Workplace outcome measurement: Short-Form Health and Labour Questionnaire (SF-HLQ) Analysis: multinomial logistic regression model	Depression and/or anxiety were significantly associated with productivity losses (i.e., absenteeism and presenteeism).
Plaisier et al. (2010)	The Netherlands	Cross-sectional	Netherlands Study of Depression and Anxiety	n = 1,976; 18-65 years old	Depression, anxiety	Absenteeism and presenteeism	Mental health measurement: Composite International Diagnostic Interview (CIDI), Beck Anxiety Inventory (BAI), Inventory for Depressive Symptomatology (IDS) Questionnaire Workplace outcome measurement: Trimbos/iMTA Questionnaire for costs associated with Psychiatric Illnesses (TiC-P) Analysis: multinomial logistic regression model	Workers with chronic depressive disorder, a generalized anxiety disorder, and more severity of both anxiety and depressive disorder had higher odds for the risk of absenteeism and decreased work performance.
Erickson et al. (2009)	USA	Longitudinal	study questionnaire/survey linked to medical records	n = 81; 18 years old and older	Anxiety	Absenteeism and presenteeism	Mental health measurement: Beck Anxiety Inventory (BAI)	Workers with greater anxiety had lower work performance (i.e., higher absenteeism and presenteeism).

							Workplace outcome measurement: Work Limitations Questionnaire (WLQ), Work Productivity and Activity Impairment Questionnaire (WPAI), Endicott Work Productivity Scale (EWPS), Functional Status Questionnaire Work Performance Scale (WPS)	
							Analysis: t-tests, chi-square tests, Cohen's d	
Fernandes et al. (2017)	Brazil	Cross-sectional	study questionnaire/survey	n = 412; over 18 years old	Anxiety disorders	Absenteeism	Mental health measurement: social security records Workplace outcome measurement: social security records Analysis: chi-square goodness of fit test, chi-square Independence test	Anxiety disorders were positively associated with absenteeism.
Park et al. (2014)	South Korea	Longitudinal	study questionnaire/survey	n = 108; 20-50 years old	Panic disorder	Absenteeism and presenteeism	Mental health measurement: Panic Disorder Severity Scale (PDSS), Hamilton Rating Scale for Depression (HAM-D) Workplace outcome measurement: WHO Health and Work Performance Questionnaire (HPQ) Analysis: chi-squared tests, t-tests	Workers with panic disorder had higher absenteeism and presenteeism.
Ling et al. (2017)	USA	Cross-sectional	National Health and Wellness Survey and Validate Attitudes and Lifestyle Issues in Depression ADHD and Troubles with Eating Survey	n = 1,720; 18 years old and older	Binge eating disorder	Absenteeism, presenteeism and activity impairment	Mental health measurement: self-report, Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) criteria Workplace outcome measurement: Work Productivity and Activity	Workers with binge eating disorders reported greater levels of presenteeism and activity impairment than those without but no differences for absenteeism.

							Impairment questionnaire (WPAI)	
							Analysis: generalized linear regression models (log link and negative binomial distribution)	
Able et al. (2014)	Multiple countries (Germany, UK, Sweden, Denmark and the Netherlands)	Cross-sectional	study questionnaire/survey	n = 880; 18-64 years old	ADHD	Absenteeism, presenteeism, overall work productivity loss and activity impairment	Mental health measurement: health care providers data, self-report, data on medications and nonpharmacological treatments Workplace outcome measurement: Work Productivity and Activity Impairment (WPAI) questionnaire	Workers with ADHD were more likely to have absenteeism, presenteeism and work impairment.
de Graaf et al. (2008)	Multiple countries (Belgium, Colombia, France, Germany, Italy, Lebanon, Mexico, the Netherlands, Spain and USA)	Cross-sectional	study questionnaire/survey	n = 7,075; 18-44 years old	ADHD	Absenteeism and presenteeism	Mental health measurement: WHO World Mental Health (WMH) survey Workplace outcome measurement: WHO Disability Assessment Schedule (WHO-DAS) Analysis: multivariate linear regression model	ADHD was associated with more annual days of excess lost role performance (i.e., absenteeism and presenteeism).
Kessler et al. (2009)	USA	Cross-sectional	study questionnaire/survey	n = 8,563; age range not specified	ADHD	Absenteeism and presenteeism, workplace accidents-injuries	Mental health measurement: WHO Adult ADHD Self-Report Scale (ASRS) Workplace outcome measurement: WHO Health and Work Performance Questionnaire (HPQ) Analysis: logistic link function, generalized linear regression model	ADHD was associated with a reduction in presenteeism (work performance), higher odds of absenteeism (sickness absence), and higher odds of workplace accidents-injuries.

Bubonya et al. (2017)	Australia	Longitudinal	Household, Income and Labour Dynamics in Australia Survey	n = 16,513 (presenteeism analysis), n= 12,560 (absenteeism analysis); 15-64 years old	Poor mental health	Absenteeism and presenteeism	Mental health measurement: Mental Health Inventory (MHI-5) Workplace outcome measurement: self-report, Short Form Health Survey (SF-36) Analysis: correlated random effects negative binomial regression model, conditional fixed-effects logit regression model	Absenteeism and presenteeism were higher among workers who reported being in poor mental health.
Wooden et al. (2016)	Australia	Longitudinal	Household, Income and Labour Dynamics in Australia Survey	n = 13,622; 15-64 years old	Poor mental health	Absenteeism	Mental health measurement: Mental Health Inventory (MHI-5) Workplace outcome measurement: self-report Analysis: correlated random effects negative binomial regression model	Poor mental health is a risk factor affecting work attendance (i.e., absenteeism), but the magnitude of this effect was modest. Due to omitted variables bias, previous research may have overstated the magnitude of the association between poor mental health and work-related sickness absence.
Mauramo et al. (2018)	Finland	Cross-sectional	Helsinki Health Study data linked to employer register data	n = 6,554; age range not specified	Common mental disorders	Absenteeism	Mental health measurement: General Health Questionnaire 12-item version (GHQ-12) Workplace outcome measurement: employer's personnel registry Analysis: quasi-Poisson regression models	Increasing severity of common mental disorders increased the risk of short, intermediate, and long absenteeism spells.

Chong et al. (2012)	Singapore	Cross-sectional	Singapore Mental Health Study	n = 6,429; 18 years and over	Multiple mental disorders	Absenteeism and presenteeism	Mental health measurement: Composite International Diagnostic Interview (CIDI) Workplace outcome measurement: Composite International Diagnostic Interview (CIDI) Analysis: negative binomial regression model	Among workers without any mental and physical disorders, absenteeism and presenteeism was significantly lower compared to those with any physical disorder only and comorbid mental-physical disorders.
de Graaf et al. (2012)	The Netherlands	Cross-sectional	Netherlands Mental Health Survey and Incidence Study	n = 4,715; 18-64 years old	Multiple mental disorders	Absenteeism and presenteeism	Mental health measurement: Composite International Diagnostic Interview (CIDI) Workplace outcome measurement: WHO Disability Assessment Schedule (WHO-DAS) Analysis: generalized linear regression models (gamma distribution, log link)	Workers with mental disorders had more work loss days due to absenteeism and presenteeism than those without mental disorders.
Hilton et al. (2010)	Australia	Cross-sectional	study questionnaire/survey	n = 60,556; over 18 years old	Multiple mental disorders	Absenteeism and presenteeism	Mental health measurement: Kessler 6 (K6), WHO Health and Work Performance Questionnaire (HPQ) Workplace outcome measurement: WHO Health and Work Performance Questionnaire (HPQ) Analysis: univariate analysis of variance (ANOVA)	Workers with higher psychological distress had lower productivity (i.e., higher absenteeism and presenteeism) than those with moderate and low distress.
Tsuchiya et al. (2012)	Japan	Cross-sectional	World Mental Health Japan 2002-2005 Survey	n = 530; 20-60 years old	Multiple mental disorders	Absenteeism and presenteeism	Mental health measurement: WHO Composite International Diagnostic Interview (CIDI) Workplace outcome measurement: WHO Health and Work Performance Questionnaire (HWP)	Mood disorders and alcohol use/dependence were associated with decreased work performance (presenteeism) but had no significant relationship with absenteeism.

							Analysis: linear regression model	
Toyoshima et al. (2020)	Japan	Cross-sectional	study questionnaire/survey	n = 477; 20 years old and older	Other disorders, including mental disorders (depressive symptoms, cognitive function)	Presenteeism	Mental health measurement: Cognitive Complaints in Bipolar Disorder Rating Assessment, Patient Health Questionnaire (PHQ-9) Workplace outcome measurement: Work Limitations Questionnaire (WLQ-8) Analysis: multiple regression model	Cognitive impairment and depressive symptoms were significant predictors of presenteeism.

Legend: ADHD – attention-deficit/hyperactivity disorder

Table 3. Comparison between the Burton et al. (2008) and the de Oliveira et al. (2022) reviews

	Burton et al. (2008) (n = 16)	de Oliveira et al. (2022) (n = 38)
Aim of review	<ol style="list-style-type: none"> 1) to summarize the literature regarding the association between mental health conditions and worker productivity 2) to review studies of workplace strategies and interventions that attempt to improve productivity for employees suffering with mental health problems 	<ol style="list-style-type: none"> 1) to update the Burton et al. (2008) review on the association between mental health and lost productivity 2) to examine how researchers have studied the relationship between mental health and lost productivity, the type of data and databases employed, the methods used, findings, and existing gaps in the literature
Time frame of analysis	not specified (includes studies from 1994 – 2007)	January 1, 2008 – May 31, 2020
Data employed	<ul style="list-style-type: none"> • national surveys • questionnaires/surveys • medical claims • firm data 	<ul style="list-style-type: none"> • national surveys • questionnaires/surveys • medical claims • firm data • randomised control trial data <p>(including data linkages)</p>
Mental disorders examined	<ul style="list-style-type: none"> • depression (including major depressive disorder, dysthymia) • bipolar disorder • anxiety • ADHD • mental disorders/multiple mental disorders 	<ul style="list-style-type: none"> • depression (including major depressive disorder) • bipolar disorder • anxiety/anxiety disorders (e.g., panic disorder) • ADHD • binge eating disorder • mental disorders/multiple mental disorder (including poor mental health)
Workplace outcomes examined	<ul style="list-style-type: none"> • absenteeism • presenteeism • productivity • work loss 	<ul style="list-style-type: none"> • absenteeism • presenteeism • productivity • employment/labour force participation

	<ul style="list-style-type: none"> • short-term disability • functional disability/status • workers compensation 	<ul style="list-style-type: none"> • short-term disability • long-term disability • activity impairment • number of weeks worked • workplace accidents-injuries
Methods	<ul style="list-style-type: none"> • regression analysis • other statistical analyses (e.g., t-tests) 	<ul style="list-style-type: none"> • regression analysis • other statistical analyses (e.g., t-tests)
Main findings	<p>Most studies found associations between mental health conditions and absenteeism (particularly short-term disability absences). In addition, results show that depression significantly impacts on-the-job productivity, i.e., presenteeism (when presenteeism is measured by a validated questionnaire).</p>	<p>Almost all studies found a positive (and, many times, a strong) association between mental health conditions and absenteeism and/or presenteeism. Nevertheless, there were a few exceptions – one study found that mood disorders were associated with decreased presenteeism (i.e., work performance) but found no significant relationship between mood disorders and absenteeism. Another study found that individuals with binge eating disorders reported greater levels of presenteeism and lost productivity than those without but found no effect for absenteeism.</p>

Legend: ADHD – attention deficit hyperactivity disorder

Figure 1. PRISMA flow diagram

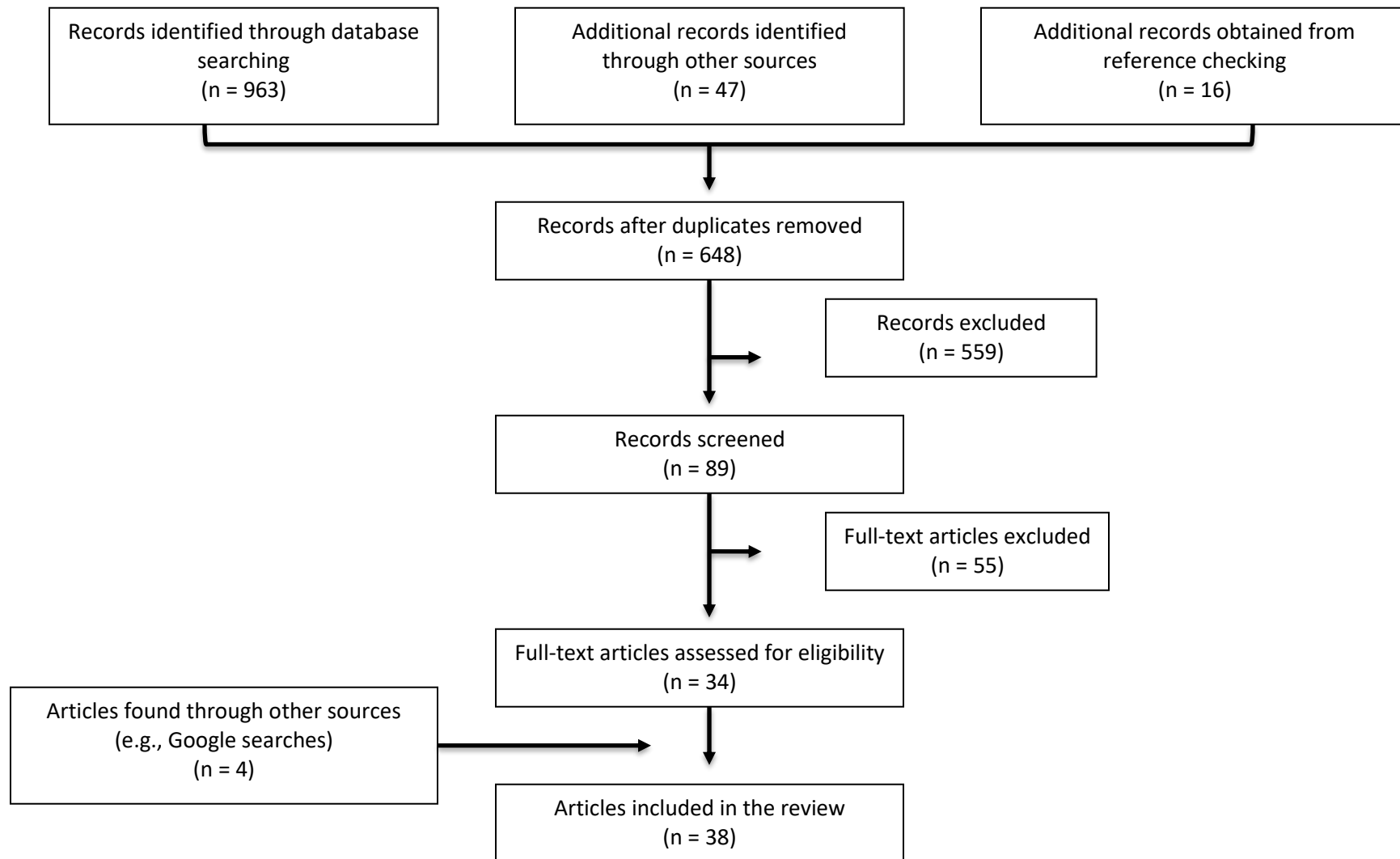
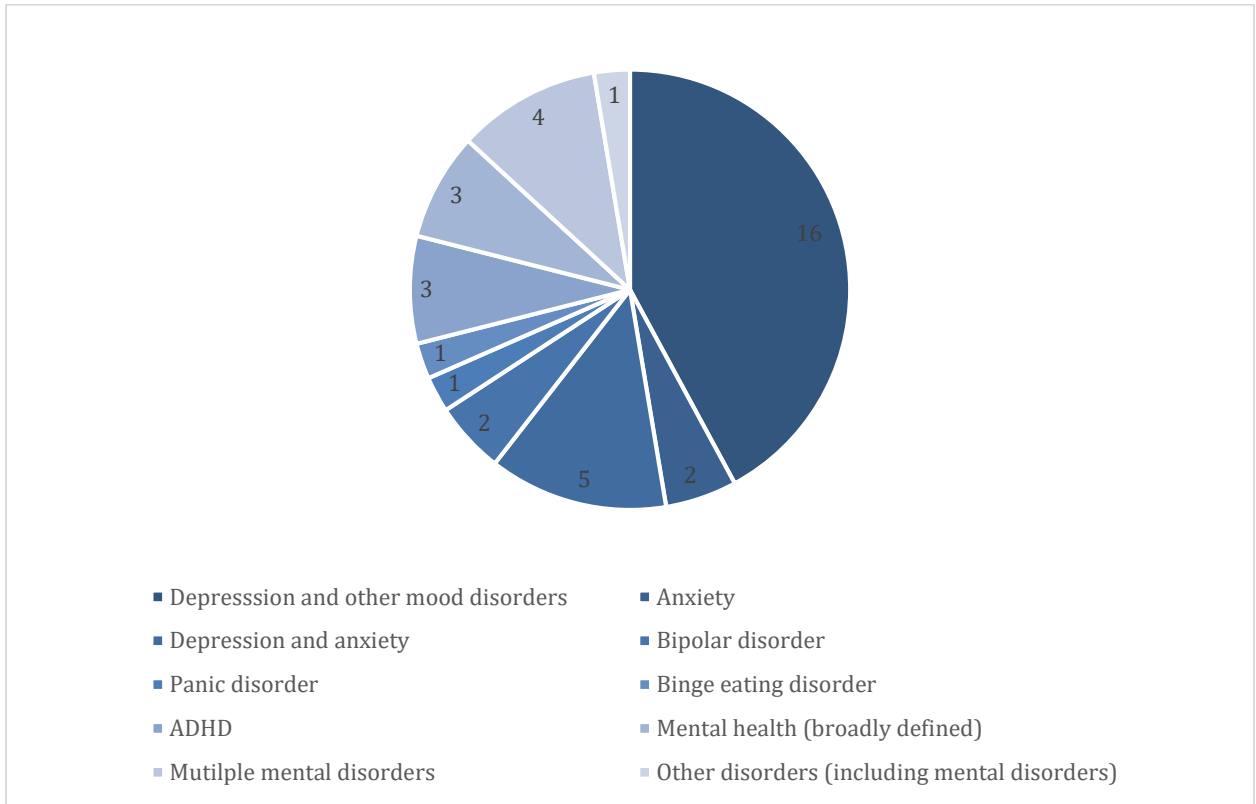
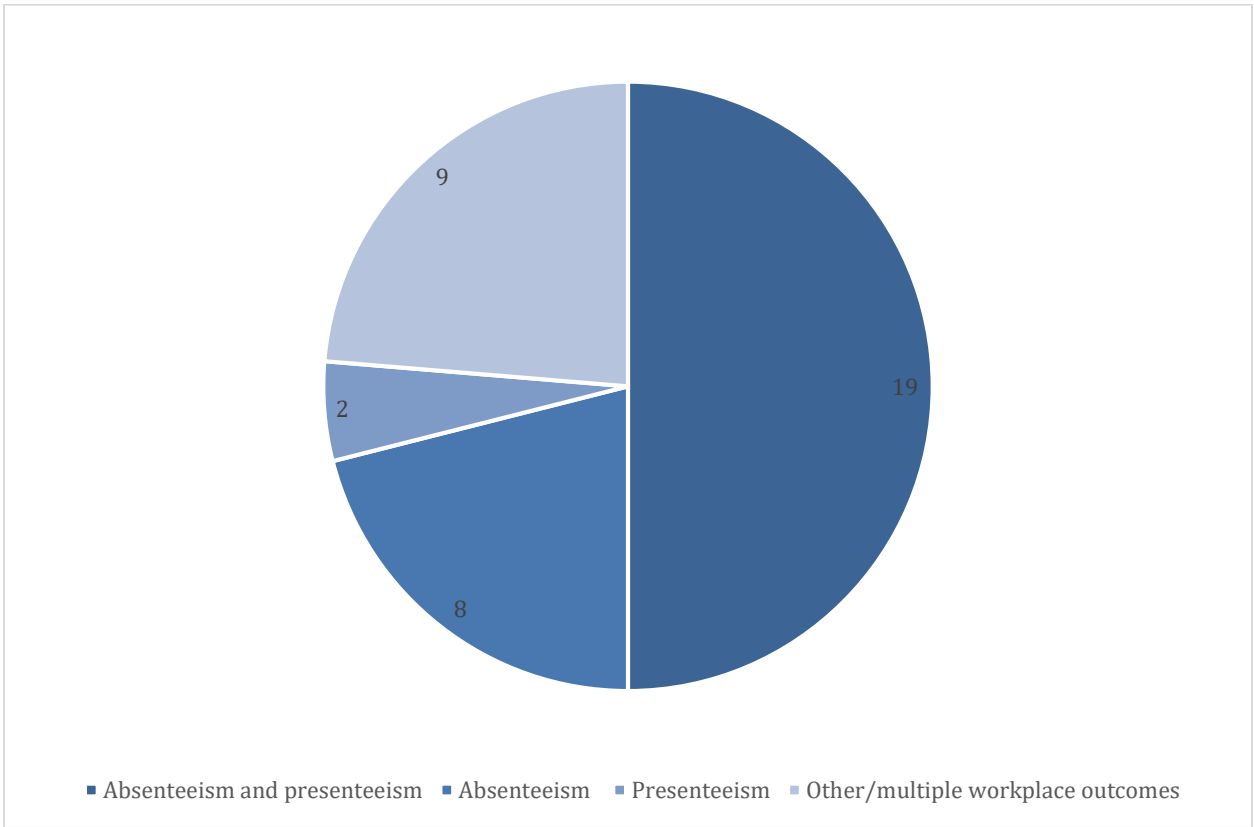


Figure 2. Studies by mental disorder



Legend: ADHD – attention deficit hyperactivity disorder

Figure 3. Studies by workplace outcome



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Appendix

Table A1. Details of included studies

Study	Country	Aim(s) of study	Study design	Data source	Study population	Mental disorder(s)	Workplace outcome(s)	Methods	Key finding(s)
Asami et al. (2015)	Japan	To investigate whether severity of depressive symptoms was associated with productivity impairments among workers, regardless of respondents' awareness of depression as exhibited in their having been diagnosed or undiagnosed	Cross-sectional	National Health and Wellness Survey	n = 17,820; 18 years and over	Depression	Absenteeism, presenteeism, overall work productivity loss and activity impairment	The Patient Health Questionnaire (PHQ-9) was used to measure the frequency and severity of depressive symptoms (and compared to self-reported diagnosis of depression). Absenteeism, presenteeism, productivity loss and activity impairment was assessed using the Work Productivity and Activity Impairment (WPAI) questionnaire. Generalized linear models specifying a negative binomial distribution and log-link function were used to model the workplace outcomes.	Among the undiagnosed, high severity workers had greater overall work impairment than low severity workers. Significant interactions between diagnosis and severity indicated greater impairments among undiagnosed than among diagnosed respondents, except on absenteeism.
Beck et al. (2011)	USA	To assess the relationship between depression symptom severity and productivity loss among patients initiating treatment for depression	Cross-sectional	study questionnaire/survey	n =771; older than 18 years old	Depression	Absenteeism and presenteeism	The Patient Health Questionnaire (PHQ-9) was used to measure severity of depression symptoms. Questions about work function were obtained from Work Productivity and Activity Impairment (WPAI) questionnaire, a self-report measure of the amount of absence from work due to health problems, as well as productivity impairment while at work (presenteeism) experienced during the previous 7 days. Generalized linear models were estimated to investigate the relationship between depression symptoms	Depression symptom severity was strongly associated with productivity loss (i.e., absenteeism [work loss] and presenteeism [productivity impairment]).

and productivity loss while adjusting for potential confounders.

Evans-Lacko and Knapp (2016)	Multiple countries (Brazil, Canada, China, Japan, South Korea, Mexico, South Africa and USA)	To estimate workplace productivity (absenteeism, presenteeism) associated with depression across eight diverse countries, to make population-level country estimates of annual absenteeism and presenteeism costs associated with depression and to examine individual, workplace and societal factors associated with lower productivity	Cross-sectional	Global Impact of Depression in the Workplace in Europe Audit Survey	n = 8,061; 18-64 years old	Depression	Absenteeism and presenteeism	Previous diagnosis of depression was determined via self-report by asking respondents, "Have you ever personally been diagnosed as having depression by a doctor/medical professional?" Self-reported presenteeism was assessed using the WHO Health and Work Performance Questionnaire (HPQ). Absenteeism was assessed using the following question, "The last time you experienced depression, how many working days did you take off work because of your depression"? Generalized linear models were used to examine bivariate and multivariable factors associated with: (a) depression-related absenteeism costs and (b) depression-related presenteeism costs. Generalized estimating equations with robust variance estimates to model within-country correlations.	Depression was positively associated with absenteeism and presenteeism across a diverse set of countries, in terms of both culture and GDP.
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Jain et al. (2013)	USA	To examine the burden of depression on work productivity	Cross-sectional	study questionnaire/survey	n = 1,051; 18 years and over	Depression	Absenteeism and presenteeism	Depression severity was assessed using the Patient Health Questionnaire (PHQ-9). Workplace productivity levels (absenteeism and presenteeism) were assessed using the Health and Work Performance Questionnaire (HPQ) and the Work Productivity and Activity Impairment Questionnaire (WPAI). The impact of the level of depression assessed by the PHQ-9 score on work productivity as measured by the HPQ and WPAI was assessed using a trend test based on an analysis of covariance.	Absenteeism and presenteeism were positively associated with severity of depression.
Johnston et al. (2019)	Australia	To investigate the relationship between overall levels of depression and individual symptoms, and workplace productivity amongst a large group of working adults	Cross-sectional	study questionnaire/survey	n = 4,953; over 18 years old	Depressive symptoms	Absenteeism and presenteeism	Depression symptomatology was measured using the PHQ-9. Work performance was assessed using a modified version of WHO-HPQ. Sickness absenteeism was assessed by asking "how many days/shifts have you missed over the past 4 weeks due to sickness absence". Presenteeism was assessed by asking "how would you rate your overall performance on the days you worked during the past 28 days?" on a scale of 0 (worse performance) to 10 (top performance). Linear regression was used to analyse the relationship between overall depression severity, sickness absenteeism and presenteeism.	Depression was positively related to presenteeism and absenteeism.
Suzuki et al. (2015)	Japan	To evaluate the influence of presenteeism on depression and	Longitudinal	study questionnaire/survey	n = 1,831; 21-65 years old	Depression	Absenteeism and presenteeism	Depression was measured with the Japanese version of the Kessler Psychological Distress Scale (K6). Sickness	Workers with higher sickness presenteeism were found to have

sickness absence due
to mental disease

presenteeism was assessed using World Health Organisation Health and Work Performance Questionnaire (WHO-HPQ). Multiple logistic regression was performed to estimate the odds ratio (OR) and 95% confidence interval (CI) of absence due to mental disease across a 2-year follow up for the lowest tertile of absolute or relative presenteeism scores at baseline as the independent variables. Furthermore, multiple logistic regression was performed to estimate the OR and 95% CI of depression one year after baseline, or increases in K6 scores for the lowest tertile of absolute or relative presenteeism scores at baseline as independent variables.

higher rates of depression and sickness absence due to mental disease.

Curkendall et al. (2010)	USA	To measure the extent to which patients receiving antidepressant therapy have reduced productivity (absenteeism and short-term disability) relative to a similar non depressed population, and to identify a subgroup of patients who have severe depression and compare their productivity losses with the population without any psychiatric conditions	Cross-sectional	administrative claims data	n = 22,427; age range not specified	Depression	Absenteeism, short-term disability	Depression was determined through claims data where individuals were included if they had been dispensed at least one prescription for an antidepressant medication and had an ICD-9-CM diagnosis of depression. The presence of and count of the number of workdays missed because of short-term disability or absence was determined through the Health and Productivity Management databases. Generalized linear models using the gamma distribution and a log link were estimated for absence costs. Two-part regression models were used for disability costs (part 1 estimated the effect of depression on the probability of incurring any short-term disability leave and part 2 estimated the effect of depression on short-term disability costs among those who took disability leave).	Workers with depression were more likely to use short-term disability leave and have higher absenteeism (even after receiving anti-depressant treatment) than those without depression.
Hjarsbech et al. (2011)	Denmark	To investigate whether and to what extent non-clinical depressive symptoms and clinical depression are prospectively associated with the risk of long-term sickness absence	Cross-sectional	study questionnaire/survey linked to register data	n = 6,985 (females only); no age range specified	Depression	Absenteeism	Depressive symptoms were measured by the Major Depression Inventory (MDI). Long-term sickness absence was determined from the Danish National Register of Social Transfer Payments. Cox's proportional hazards model was used to calculate hazard ratios to analyse whether and to what extent depressive symptoms at baseline predicted time to onset of first long-term sickness absence during the 1 year follow up.	Reduced psychological health was associated with absenteeism.

Koopmans et al. (2008)	The Netherlands	To determine the duration of sickness absence due to depressive symptoms in the working population	Cross-sectional	firm data	n = 9,450; age range not specified	Depression	Absenteeism	Data on sickness absence due to depressive symptoms were obtained from the occupational health department's registration system. Absence periods were encoded by an occupational physician when symptoms were present. Kaplan-Meier survival curves were computed to determine the mean and median absence duration of sickness absence due to depressive symptoms.	Workers with depressive symptoms had longer episodes of absenteeism.
Lamichhanne et al. (2017)	South Korea	To examine how depressive symptoms are prospectively associated with absence from work due to illness and accidents in Korean manufacturing workers	Cross-sectional	study questionnaire/survey	n = 2,349; no age range specified	Depression, depressive symptoms	Absenteeism	Depressive symptoms were measured using the Korean version of the Center for Epidemiologic Studies Depression Scale (CES-D). Absence due to accident and illness was determined using the following questions: (1) "Were absent from work because of any accident occurring at work in the past year?" or (2) "Were absent from work due to illness in the past year?" Several multivariable logistic regression models were used to estimate the odds ratio for depressive symptoms for absence.	Workers with depressive symptoms (CES-D ≥ 16) were found to have higher odds of absenteeism.
Harvey et al. (2011)	United Kingdom	To test whether a web-based screening tool for depression could be used successfully in the workplace and whether it was possible to detect an association between rates of depression and objective measures of impaired workgroup performance	Cross-sectional	study questionnaire/survey	n = 1,161; age range not specified	Depression	Presenteeism	Depression was measured by the Patient Health Questionnaire depression scale (PHQ-9). Work performance (i.e., presenteeism) was defined based on number of senior consultations required, number of calls transferred, adherence (inverse percentage of the total online hours occurring compared with the total scheduled) and customer time (amount of call, wrap, offline and wait time as a percent of	Depressive symptoms were positively related to presenteeism (i.e., poorer work performance).

								the scheduled hours plus overtime). The association between group level measures of depressive symptoms and performance was initially assessed using univariate linear regression. Multivariable models were then constructed to examine the impact of potential confounding factors.	
Ammerman et al. (2016)	USA	To determine the health care and labour productivity costs associated with major depressive disorder in high-risk, low-income mothers	Cross-sectional	Medical Expenditure Panel Survey	n = 20,531 (females only); 18-35 years old	Major depressive disorder	Absenteeism	Depression was ascertained using the International Classification of Diseases, 9th Revision (ICD-9) diagnosis code of 296 or 311. Labour productivity outcomes were obtained from the survey and included employment status and, if working, whether any work days were missed during the year and the number of work days missed among subjects missing at least one day. Two part models were used to model job absenteeism costs (in the 1st stage, logistic regression models were estimated to predict the probability of any job absenteeism; the 2nd stage estimated the number of days missed for all subjects missing at least one day).	Depression significantly increased the likelihood of absenteeism among high-risk, low-income mothers.

Buist-Bouwman et al. (2008)	Multiple countries (Belgium, France, Germany, Italy, the Netherlands and Spain)	To evaluate which limitations mediate in the relation between depression and role functioning, and to address which activity limitations mediate most of the effect and the robustness of the findings, especially across different levels of mental and physical comorbidity	Cross-sectional	European Study of the Epidemiology of Mental Disorders data	n = 5,565; 18 years old and older	Major depressive episode	Absenteeism and presenteeism	The Composite International Diagnostic Interview (CIDI) was used to assess depression. The European Study of the Epidemiology of Mental Disorders-WHO Disability Assessment Schedule (ESEMeD-WHODAS) was used to assess role functioning (i.e., absenteeism and presenteeism) in paid employment. A structural equation model for categorical and ordinal data was used to estimate the extent to which limitations mediated the association between depression and role functioning. Structural equation models for categorical and ordinal data were used to estimate the extent to which limitations mediated the association between major depressive episode and role functioning.	Depression had a strong negative effect on role functioning (i.e., absenteeism and presenteeism) mediated by cognition and feelings of embarrassment.
Hees et al. (2013)	The Netherlands	To examine both the temporal and directional relationship between depressive symptoms and various work outcomes (absenteeism, work productivity and work limitations) in patients with long-term sickness absence related to major depressive disorder	Longitudinal	study questionnaire/survey	n = 117; 18-65 years old	Major depressive disorder	Absenteeism and presenteeism	Severity of depressive symptoms was assessed by the Hamilton Rating Scale for Depression (HRSD). Absenteeism was assessed using self-report diaries, where patients recorded the number of contract hours and hours of sickness absence. Work productivity was assessed using self-report records of work productivity on a scale of 1 ('not productive at all') to 10 ('very productive'). Work limitations were assessed with three subscales of the Work Limitations Questionnaire (WLQ). Regression analysis was used to model work outcomes over time. To examine the	Higher level of depressive symptoms was associated with a decrease in work productivity (i.e., presenteeism), and an increase in absenteeism and work limitations.

								direction of the relationship (i.e., the association between earlier depressive symptoms and later work outcomes, and the association between earlier work outcomes and later depressive symptoms), autoregressive models were used.	
Uribe et al. (2017)	Colombia	To estimate productivity losses due to absenteeism and presenteeism and their determinants in patients with depression	Cross-sectional	study questionnaire/survey	n = 107; 18-65 years old	Major depressive disorder	Absenteeism and presenteeism	The diagnosis of major depressive disorder or double depression was determined according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders (4th ed., Text Revision) and the International Classification of Diseases, Tenth Revision. The World Health Organisation's Health and Work Performance Questionnaire (HPQ) was used to assess absenteeism and presenteeism. The relationship between major depressive disorder and absenteeism and presenteeism were examined using regression analysis [two-part model for absenteeism (1st part = probit regression, 2nd part = ordinary least squares regression) and linear regression for presenteeism = linear regression].	Workers who rated their mental health favourably had a lower probability of absenteeism and fewer hours per month of presenteeism.
Woo et al. (2011)	South Korea	To estimate the lost productive time and its resulting cost among workers with major depressive disorder compared with a comparison group, and to estimate the change in productivity after 8 weeks of outpatient	Longitudinal	study questionnaire/survey	n =193; 20-60 years old	Major depressive disorder	Absenteeism and presenteeism	The Korean version of Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders was used to diagnose major depressive disorder. The Hamilton Rating Scales for Depression (HAM-D) was used to measure the severity of depressive symptoms. The Korean version of the Health and Work Performance	Workers with major depressive disorder had significantly higher absenteeism and presenteeism than those without medical psychiatric illness. After 8 weeks of treatment, absenteeism and

		psychiatric treatment with antidepressants						Questionnaire (HPQ) was used to measure productivity (absenteeism and presenteeism). T-tests, chi-square tests, and analysis of variance tests were performed depending on whether the variables were continuous or categorical, comparing subjects' demographic data and the data from the HPQ. The comparison group was compared to the major depressive disorder group at baseline, and the major depressive disorder group before and after treatment.	clinical symptoms of depression were significantly reduced and associated with significant improvement in self-rated job performance.
Simon et al. (2008)	USA	To evaluate the relationship between mood symptoms and work productivity in people treated for bipolar disorder	Longitudinal	study questionnaire/survey	n = 412; 64 years old and under	Bipolar disorder	Absenteeism, employment	Bipolar disorder was determined through the use of the Structured Clinical Interview for DSM-IV (SCID) (current depression, past depression, current mania, past mania, substance abuse). Workplace outcomes were determined through questions regarding days of disability adapted from the National Health Interview Survey. Regression analysis was performed to examine the probability of paid employment using generalized estimating equations with a log link and the relationship between the number of days missed from work and severity of mood symptoms using generalized estimating equations with a linear link.	Major depression was strongly and consistently associated with decreased probability of employment and absenteeism; symptoms of mania or hypomania were not significantly associated with employment or absenteeism.

McMorris et al. (2010)	USA	To evaluate a group of subjects with bipolar I disorder by collecting data on workplace productivity, employment issues and healthcare resource utilisation, and to compare the results with those from a group of subjects with no history of any type of bipolar disorder/serious mental illness	Cross-sectional	study questionnaire/survey	n =417; 18-64 years old	Bipolar disorder	Absenteeism, workplace productivity, short- and long-term disability	Bipolar disorder was determined using the Mood Disorder Questionnaire (MCQ). Workplace outcomes were determined using the Endicott Work Productivity Scale (EWPS). Linear regression analyses were conducted to compare the results from subjects in the bipolar I disorder group with the results from the normative group on measures of work productivity.	Workers with bipolar disorder were more likely to report lower levels of workplace productivity, more likely to miss work, have worked reduced hours due to medical or mental health issues, and receive disability payments.
Banerjee et al. (2017)	USA	To estimate the effect of mental illness on labour market outcomes using a structural equation model with a latent index for mental illness	Cross-sectional	National Comorbidity Survey Replication and the National Latino and Asian American Study	n = 7,566; 25-64 years old	Major depressive episode, anxiety (social phobia, panic attack, generalised anxiety disorder)	Absenteeism, employment, labour force participation, number of weeks worked	Clinical diagnoses of psychiatric disorders were determined based on the responses to survey questions. Data are on labour market outcomes were obtained from survey responses. The effect of psychiatric disorders on labour market outcomes was estimated using a Multiple Indicator and Multiple Cause model (i.e., a structural equation model). In addition, the potentially endogenous nature of the mental illness variable was addressed using covariance instruments.	Mental illness adversely affects employment and labour force participation and reduces the number of weeks worked and increases work absenteeism.

Knudsen et al. (2013)	Norway	To examine and compare the prospective effect of the common mental disorders (anxiety and depression) on duration and recurrence of sickness absence, and to investigate whether the effect of common mental disorder on sickness absence is detectable over time	Longitudinal	Hordaland Health Study data linked to state registry data	n = 13,436; age range not specified	Depression, anxiety	Absenteeism	Anxiety and depression were assessed with the Hospital Anxiety and Depression Scale (HADS). Information on sickness absence (SA) episodes was retrieved from official Norwegian registries over state paid SA benefits. The effects of anxiety and depression on first sickness absence episode, the duration of the first sickness absence episode, and whether the effect remained over prolonged time after baseline, were assessed using Cox regression. The association between anxiety and depression and the number of sickness absence episodes was examined using multinomial logistic regression.	Comorbid anxiety and depression, and anxiety only were significant risk factors for absenteeism, while depression only was not. Anxiety and depression were stronger predictors for longer duration and with more frequent recurrence of absenteeism.
Bokma et al. (2017)	The Netherlands	To expand on the current literature by studying severity of disability, work absenteeism and presenteeism associated with anxiety and/or depressive disorders, chronic somatic diseases and their comorbidity in a wide range of chronic somatic diseases	Cross-sectional	Netherlands Study of Depression and Anxiety	n = 1,462; 18-65 years old	Depressive disorders, anxiety	Absenteeism, presenteeism and disability	The Composite International Diagnostic Interview (CIDI) was used to assess mental illness. Disability during the previous 30 days was assessed using the WHO-Disability Assessment Schedule (WHO-DAS II). Trimbos/iMTA questionnaire for Costs Associated with Psychiatric illness (TiC-P) was used to assess absenteeism and presenteeism. Statistical analyses (including multivariate regression models) were used to compare baseline characteristics of anxiety and/or depressive disorders, to compare presence of chronic somatic diseases in anxiety and/or depressive disorders patients versus controls, to test the impact of anxiety and/or depressive disorders, chronic somatic	Anxiety and depressive disorders were associated with worse absenteeism and presenteeism outcomes and disability (compared to chronic somatic diseases).

								diseases, and their interaction on disability total and domain scores, patients to controls, and to test the impact of anxiety and/or depressive disorders, chronic somatic diseases, and physical mental-comorbidity on work absenteeism and presenteeism. Sensitivity analyses were done to check for possible bias.	
Bouwman et al. (2014)	The Netherlands	To assess the explanatory power of disease severity and health-related quality of life on absenteeism and presenteeism in a working population suffering from depression and/or anxiety disorders	Cross-sectional	randomised control trial data	n = 425; age range not specified	Depression, anxiety	Absenteeism and presenteeism	Depression and/or anxiety disorder was determined using the Composite International Diagnostic Interview (CIDI). Productivity losses (absenteeism and presenteeism) were measured using the Short-Form Health and Labour Questionnaire (SF-HLQ). Multinomial logistic regression analyses were performed to explore associations of the type of the disorder and health-related quality of life with different types of productivity losses. Multivariate regression analyses were performed to assess associations with the duration of absenteeism.	Depression and/or anxiety were significantly associated with productivity losses (i.e., absenteeism and presenteeism).
Plaisier et al. (2010)	The Netherlands	To examine and compare psychopathological characteristics of depressive and anxiety disorders in their effect on work functioning	Cross-sectional	Netherlands Study of Depression and Anxiety	n = 1,976; 18-65 years old	Depression, anxiety	Absenteeism and presenteeism	The Composite International Diagnostic Interview (CIDI, lifetime version 2.1) was used to diagnose depressive and anxiety disorders. Severity of anxiety/depressive symptoms (in the last week) was assessed by the Beck Anxiety Inventory (BAI) and the Inventory for Depressive Symptomatology (IDS) Questionnaire, respectively. Work functioning (i.e., absenteeism and presenteeism) was assessed	Workers with chronic depressive disorder, a generalized anxiety disorder, and more severity of both anxiety and depressive disorder had higher odds for the risk of absenteeism and decreased work performance.

								with the Trimbos/iMTA Questionnaire for costs associated with Psychiatric Illnesses (TiC-P). Multinomial logistic regression analyses were used to test associations of socio-demographic characteristics, somatic health and diagnoses of anxiety and depression with categories of work absenteeism and decreased work performance.	
Erickson et al. (2009)	USA	To examine the impact of anxiety severity on work-related outcomes in an anxiety specialty clinic population, and to examine psychometric properties (sensitivity, internal reliability, and construct validity) of the four instruments and to assess their relative suitability for use in this population	Longitudinal	study questionnaire/survey linked to medical records	n = 81; 18 years old and older	Anxiety	Absenteeism and presenteeism	Anxiety severity was determined using the Beck Anxiety Inventory (BAI). Self-reported work-productivity was measured using 4 work performance measures: 1) Work Limitations Questionnaire (WLQ); 2) Work Productivity and Activity Impairment Questionnaire (WPAI); 3) Endicott Work Productivity Scale (EWPS); 4) Functional Status Questionnaire Work Performance Scale (WPS). Workers were divided into two groups (high and low anxiety) and compared on demographic, job, and work-related data using t-tests and chi-square tests. Effect sizes for differences between groups were calculated using Cohen's d.	Workers with greater anxiety had lower work performance (i.e., higher absenteeism and presenteeism).
Fernandes et al. (2017)	Brazil	To analyse the prevalence of various anxiety disorders among mental and behavioural disorders as a cause for the leave of absence of workers	Cross-sectional	study questionnaire/survey	n = 412; over 18 years old	Anxiety disorders (mixed anxiety-depressed disorder, generalised anxiety disorder, panic disorder, reaction to severe stress and	Absenteeism	The Unified Benefits System from the National Social Security Institute of the city of Teresina, Piauí, Brazil was used to obtain data on sick pay and disability retirement due to anxiety disorders. Statistical analyses were used to analyse the prevalence of anxiety disorders as a cause of workers'	Anxiety disorders were positively associated with absenteeism.

						adjustment disorders, acute reaction to stress, PTSD, adjustment disorder, obsessive compulsive disorder)		absence. A chi-square goodness of fit test was used to examine the difference between the frequencies of a same variable's categories and a chi-square Independence test was used to verify the association between time of absence and the variables related to social security and socio-demographic characteristics.	
Park et al. (2014)	South Korea	To measure the lost productivity for working patients with panic disorder	Longitudinal	study questionnaire/survey	n = 108; 20-50 years old	Panic disorder	Absenteeism and presenteeism	The Panic Disorder Severity Scale (PDSS) was administered to assess the severity of symptoms of panic disorder and the Hamilton Rating Scale for Depression (HAM-D) was administered to assess depressive symptoms. The Korean version of the WHO Health and Work Performance Questionnaire (HPQ) was administered to measure lost workplace productive time, absenteeism and presenteeism. Chi-squared and t-tests were undertaken to compare demographic data, the HPQ, and the HAM-D between the panic disorder group and the matched control group and similar chi-squared and paired t-test analyses were performed to compare the panic disorder group at baseline and after treatment.	Workers with panic disorder had higher absenteeism and presenteeism.
Ling et al. (2017)	USA	To quantify the economic burden of binge-eating disorder in terms of work productivity loss, healthcare resource	Cross-sectional	National Health and Wellness Survey and Validate Attitudes and Lifestyle	n = 1,720; 18 years old and older	Binge eating disorder	Absenteeism, presenteeism and activity impairment	The presence of binge eating disorder was determined using self-reported data regarding the specific features and symptoms of binge eating disorder in Diagnostic and Statistical Manual of Mental Disorders, 5th	Workers with binge eating disorders reported greater levels of presenteeism and activity impairment than

		utilisation, and health care costs		Issues in Depression ADHD and Troubles with Eating Survey				Edition (DSM-5) criteria. Information on work productivity was collected using the Work Productivity and Activity Impairment questionnaire (WPAI). Generalized linear models with a log link and a negative binomial distribution were used to estimate work productivity loss and health care resource utilisation.	those without but no differences for absenteeism.
Able et al. (2014)	Multiple countries (Germany, UK, Sweden, Denmark and the Netherlands)	To quantitatively address the burden of attention-deficit/hyperactivity disorder (ADHD) in Europe (Germany, the UK, Sweden, Denmark, and the Netherlands), to describe adult experience leading to diagnosis and treatment of ADHD, and to compare those findings with results from the USA	Cross-sectional	study questionnaire/survey	n = 880; 18-64 years old	ADHD	Absenteeism, presenteeism, overall work productivity loss and activity impairment	The diagnosis of and treatment for ADHD was ascertained using the following information: 1) the specialties of health care providers consulted regarding ADHD symptoms prior to diagnosis; 2) the specialties of health care providers initially diagnosing ADHD; 3) the time to diagnosis following the first visit to a health care provider for consultation regarding ADHD symptoms; 4) conditions for which respondents received diagnoses prior to their initial ADHD diagnosis (alcoholism, autism, Asperger syndrome, other substance use/abuse, bipolar disorder, depression, anxiety-related disorder, schizophrenia, any learning disability, conduct disorder, and any other mental health conditions); 5) respondent evaluations of opinions on health care providers and services; 6) current use of ADHD medications; and 7) types of nonpharmacological treatments ever received for ADHD. The Work Productivity and Activity Impairment	Workers with ADHD were more likely to have absenteeism, presenteeism and work impairment.

								(WPAI) questionnaire was used to measure absenteeism, presenteeism, overall work productivity loss, and activity impairment. Multivariate linear regression analyses were used to compare the impact of ADHD on work productivity and activity impairments.	
de Graaf et al. (2008)	Multiple countries (Belgium, Colombia, France, Germany, Italy, Lebanon, Mexico, the Netherlands, Spain and USA)	To estimate the prevalence and workplace consequences of adult attention-deficit/hyperactivity disorder (ADHD)	Cross-sectional	study questionnaire/survey	n = 7,075; 18-44 years old	ADHD	Absenteeism and presenteeism	ADHD was determined using the WHO World Mental Health (WMH) survey. Days out of role were measured using the WHO Disability Assessment Schedule (WHO-DAS). Linear regression analysis was used to estimate associations of ADHD with lost role performance.	ADHD was associated with more annual days of excess lost role performance (i.e., absenteeism and presenteeism).
Kessler et al. (2009)	USA	To determine the prevalence and workplace costs of ADHD in order to evaluate the possible return on investment of a workplace screening-treatment program for workers with ADHD	Cross-sectional	study questionnaire/survey	n = 8,563; age range not specified	ADHD	Absenteeism and presenteeism, workplace accidents-injuries	ADHD was assessed with the WHO Adult ADHD Self-Report Scale (ASRS). Sickness absence, work performance and workplace accidents-injuries were assessed using the WHO Health and Work Performance Questionnaire (HPQ). A logistic link function was used to predict any sickness absence and any workplace accident-injury and a generalized linear model that allowed for non-linear link functions and for non-normal distributions of prediction errors was used to predict the number of sickness absence days and work performance.	ADHD was associated with a reduction in presenteeism (work performance), higher odds of absenteeism (sickness absence), and higher odds of workplace accidents-injuries.

Bubonya et al. (2017)	Australia	To analyse the relationship between mental health and workplace productivity (absenteeism and presenteeism)	Longitudinal	Household, Income and Labour Dynamics in Australia Survey	n = 16,513 (presenteeism analysis), n= 12,560 (absenteeism analysis); 15-64 years old	Poor mental health	Absenteeism and presenteeism	Mental health was derived from the Mental Health Inventory (MHI-5). Absenteeism was determined using a self-reported measure of the number of paid sick leave days taken in the previous 12 months. Presenteeism was derived from Short Form Health Survey (SF-36). Absenteeism was modeled using a correlated random effects negative binomial model. Presenteeism was modeled using a conditional fixed-effects logit model.	Absenteeism and presenteeism were higher among workers who reported being in poor mental health.
Wooden et al. (2016)	Australia	To revisit the relationship between mental health and sickness absence and to quantify the bias due to unobserved characteristics that are time invariant	Longitudinal	Household, Income and Labour Dynamics in Australia Survey	n = 13,622; 15-64 years old	Poor mental health	Absenteeism	Mental health was measured with the five-item Mental Health Inventory (MHI-5). Absenteeism was determined using a self-reported count of the number of days absent from work while on paid sick leave during the previous 12 months. Correlated random effects negative binomial regression models were used to model the number of annual paid sickness absence days.	Poor mental health is a risk factor affecting work attendance (i.e., absenteeism), but the magnitude of this effect, at least in a country where the rate of sickness absence is relatively low, was modest. As a result of omitted variables bias, previous research may have overstated the magnitude of the association between poor mental health and work-related sickness absence.

Mauramo et al. (2018)	Finland	To examine whether common mental disorders at different severity levels are associated with sickness absence in a Finnish cohort of midlife and aging female and male municipal employees	Cross-sectional	Helsinki Health Study data linked to employer register data	n = 6,554; age range not specified	Common mental disorders	Absenteeism	The General Health Questionnaire 12-item version (GHQ-12) was used to measure common mental disorders. Sickness absence spells were obtained from the employer's personnel registry. Quasi-Poisson regression models producing rate ratios with 95% confidence intervals were fitted to examine associations between common mental disorders and the number of sickness absence spells in the follow-up of 5 years.	Increasing severity of common mental disorders increased the risk of short, intermediate, and long absenteeism spells.
Chong et al. (2012)	Singapore	To examine the association between mental disorders and work disability in the adult resident population	Cross-sectional	Singapore Mental Health Study	n = 6,429; 18 years and over	Multiple mental disorders (major depression disorder, dysthymia, bipolar disorder, generalised anxiety disorder, obsessive compulsive disorder, alcohol use disorder, alcohol dependency)	Absenteeism and presenteeism	The Composite International Diagnostic Interview (CIDI) was used to assess mental disorders. Employment-related information was collected using the modified employment module of the CIDI. Negative binomial regression was used to model the main effect of DSM-IV lifetime mental disorders, physical disorder, and comorbid mental-physical disorder on the rate of work-lost days (absenteeism) and work-cut days (presenteeism).	Among workers without any mental and physical disorders, absenteeism and presenteeism was significantly lower compared to those with any physical disorder only and comorbid mental-physical disorders.

de Graaf et al. (2012)	The Netherlands	To estimate work loss days due to absenteeism and presenteeism associated with commonly occurring mental and physical disorders	Cross-sectional	Netherlands Mental Health Survey and Incidence Study	n = 4,715; 18-64 years old	Multiple mental disorders (major depression disorder, dysthymia, bipolar disorder, anxiety [panic disorder, agoraphobia, social phobia, specific phobia, generalised anxiety disorder], substance use disorders, ADHD)	Absenteeism and presenteeism	Mental disorders were assessed using the Composite International Diagnostic Interview (CIDI). Number of absent days and days of reduced quantitative and qualitative functioning while at work were measured by three questions based on the WHO Disability Assessment Schedule (WHO-DAS) ("How many days out of the past 30 were you totally unable to work or carry out your normal activities? How many days out of the past 30 were you able to work and carry out your normal activities, but had to cut down on what you did or not get as much done as usual? How many days out of the past 30 did you cut back on the quality of your work or how carefully you worked?") Generalized linear models with gamma distribution and log link function were used to examine the relationship between work-related outcomes and mental disorders.	Workers with mental disorders had more work loss days due to absenteeism and presenteeism than those without mental disorders.
Hilton et al. (2010)	Australia	To estimate employee work productivity by mental health symptoms while considering different treatment-seeking behaviours	Cross-sectional	study questionnaire/survey	n = 60,556; over 18 years old	Multiple mental disorders (depression, anxiety and other emotional problems)	Absenteeism and presenteeism	The Kessler 6 (K6) was used to gauge severity of mental health symptoms, and specific WHO Health and Work Performance Questionnaire (HPQ) questions relating to three types of mental disorders (depression, anxiety and other emotional problems) was used to gauge treatment seeking behaviours. The WHO and Work Performance Questionnaire (HPQ) was used to measure workplace productivity. A univariate analysis of variance (ANOVA)	Workers with higher psychological distress had lower productivity (i.e., higher absenteeism and presenteeism) than those with moderate and low distress.

								was performed to understand the relationship between productivity and K6 severity categories and treatment-seeking behaviours.	
Tsuchiya et al. (2012)	Japan	To estimate the impact of mental disorders on work performance (absenteeism and presenteeism), as well as to ascertain the prevalence and demographic correlates in a community sample of workers	Cross-sectional	World Mental Health Japan 2002-2005 Survey	n = 530; 20-60 years old	Multiple mental disorders (major depressive disorder, dysthymia, bipolar disorder I and II, specific phobia, social phobia, agoraphobia without panic disorder, generalised anxiety disorder, panic disorder, PTSD)	Absenteeism and presenteeism	Mental disorders were assessed using version 3.0 of the WHO Composite International Diagnostic Interview (CIDI). Work performance was assessed using the WHO Health and Work Performance Questionnaire (HWP). Regression analysis (i.e., linear regression model) was used to estimate the associations of mental disorders with work performance over 30 days and 12 months.	Mood disorders, including major depressive disorder, and alcohol use/dependence were associated with decreased work performance (presenteeism) but had no significant relationship with absenteeism.
Toyoshima et al. (2020)	Japan	To investigate the correlation between cognitive complaints, depressive symptoms and presenteeism of adult workers	Cross-sectional	study questionnaire/survey	n = 477; 20 years old and older	Other disorders, including mental disorders (depressive symptoms, cognitive function)	Presenteeism	Subjective cognitive function was evaluated using the Cognitive Complaints in Bipolar Disorder Rating Assessment and depressive symptoms were assessed using the Patient Health Questionnaire (PHQ-9). Work limitations were determined using the Work Limitations Questionnaire (WLQ-8). The relationship between depressive symptoms, cognitive complaints and work limitations was examined using multiple regression analysis.	Cognitive impairment and depressive symptoms were significant predictors of presenteeism.