**Economic analyses of workplace mental health/substance use interventions: a systematic literature review and narrative synthesis**

Claire de Oliveira, Edward Cho, RuthAnne Kavelaars, Margaret Jamieson, Buddy Bao, and Jürgen Rehm

**Institute for Mental Health Policy Research, Centre for Addiction and Mental Health** (C de Oliveira PhD, E Cho MSc, RA Kavelaars MSc, M Jamieson MSc, B Bao MSc, and Prof J Rehm PhD) **Centre for Health Economics and Hull York Medical School, University of York** (C de Oliveira PhD) **Institute of Health Policy, Management and Evaluation, University of Toronto** (C de Oliveira PhD) **Dalla Lana School of Public Health, University of Toronto** (Prof J Rehm PhD) **Epidemiological Research Unit, Technische Universität Dresden** (Prof J Rehm PhD) **Department of International Health Projects, Institute for Leadership and Health Management, I.M. Sechenov First Moscow State Medical University** (Prof J Rehm PhD)

Correspondence to:

Dr Claire de Oliveira, Centre for Health Economics and Hull York Medical School, Alcuin A Block, University of York, York YO10 5DD, UK

[**claire.deoliveira@york.ac.uk**](mailto:claire.deoliveira@york.ac.uk)

+44 (0)1904 321 1438

**Abstract**

Workplace mental health/substance use disorders have been increasingly recognised as a problem in most countries; however, there is limited evidence on which solutions provide the highest return. We searched academic and grey literature databases and additional sources to determine the highest yielding and most cost-effective interventions by disorder. Based on 56 studies, we found moderate evidence that cognitive-behavioural therapy is cost saving (and in some cases cost-effective) to address depression, strong evidence that regular and active involvement of occupational health professionals is cost saving and cost-effective in reducing mental health-related sick leave and encouraging return to work, and moderate evidence that smoking cessation drug coverage and brief counselling are both cost saving and cost-effective. Addressing workplace mental health/substance use improves workers’ wellbeing and productivity, and benefits employers’ bottom line. Nonetheless, future economic analyses would benefit from the consideration of subgroup analyses, examination of longer time horizons, inclusion of statistical and sensitivity analyses and discussion around uncertainty, and consideration of potential for bias.

**Introduction**

According to the World Health Organization, mental illnesses were the leading cause of years of life lost to disabilities in 2016.1 Depression alone was responsible for almost one third of this burden.1 Depending on the estimation method (human capital approach versus statistical life approach), the global economic burden of mental illness has been estimated to be USD 2.5/8.5 trillion in 2010 and is expected to rise to USD 6.1/16.5 trillion in 2030, respectively,2 most of which is due to absenteeism, presenteeism and lost productivity.

Workplaces that promote mental health and support individuals with mental illnesses are more likely to reduce absenteeism and presenteeism, increase productivity, and may benefit from resulting economic gains. Thus, in addition to understanding whether workplace interventions work or not (i.e., whether they are effective), employers are keen to understand whether their investments are cost saving (i.e., whether the financial benefits exceed the investment costs and thus the return on investment is positive) and/or cost-effective (i.e., whether the effects on mental health or quality of life present good value for the money invested).

There is a growing body of international evidence, which shows that initiatives around promotion, prevention, and early intervention can provide positive returns on investment.3,4 However, there is limited evidence on *which* solutions provide the highest return on investment; as a result, few employers have adopted these initiatives.5 Previous reviews have found few studies on workplace mental health interventions, most of which were of low quality; moreover, these reviews have not examined substance use.6,7

The objectives of this review were to provide a comprehensive overview of the existing literature on workplace interventions targeting mental health *and* substance use disorders and that have measured the resulting economic/financial return as well as provide a list of the highest yielding and most cost-effective interventions by disorder.

**Methods**

**Search strategy and selection criteria**

We included all studies that examined mental health and/or substance use workplace interventions targeting employed adults (ages 18+) and that included an economic analysis. We used the PICOS (Population, Intervention, Comparison, Outcome, Study design) criteria to guide the development of the search strategy. Our population included all employed adults with a mental health and/or substance use disorder and excluded individuals under the age of 18, unpaid workers and individuals beyond workers (e.g., spouses). The intervention had to target mental health and/or substance use, improve a work-related outcome and be provided in a workplace or be sponsored by the employer; exclusions included all interventions without an explicit focus on improving mental health and/or substance use, those provided outside of a workplace setting/context and those implemented at a jurisdictional level (furthermore, all studies on workplace interventions of supported employment/accommodation were excluded as these have different objectives than generic workplace interventions). The comparator had to be usual care or no care; studies without a control/comparison group were excluded (except pre-test-post-test analyses of the same population). Outcomes included mental health and/or substance use, work-related outcomes, such as productivity, and economic/financial-related outcomes, such as return on investment; studies that did not examine mental health and/or substance use or that examined sleep-related disorders (e.g. insomnia) were excluded. The study design had to include a before-after case-control or pre-test-post-test component, where measurement of change was present, and include an economic analysis but otherwise was not restricted; studies were excluded only if there was no measurement of change in mental health and/or substance use and did not include an economic analysis.

We searched the literature published in English, French, German, Portuguese, Spanish, and Korean between January 1 2000 and December 31 2018 to ensure that studies were still relevant to ever-evolving workplace practices and treatments. Relevant studies were identified through: 1) structured searches in peer-reviewed academic literature databases; 2) structured searches in grey literature databases; and 3) searches in other sources, such as a) Google and Google scholar; b) relevant mental health- and/or workplace-related websites (see pages 1-3, Appendix); c) hand search of relevant field-specific journals (see page 4, Appendix); d) hand search of references of key papers and reviews (i.e., snowballing); and e) studies identified by content experts (i.e., individuals with expertise and/or who had published on the topic) (see pages 5-6, Appendix).

Structured searches were undertaken in PubMed, MEDLINE, Embase, CINAHL, PsycINFO, Web of Science Core Collection, Scopus, EconLit, Business Source Premier, Health Business Elite, NHS Economic Evaluation Database (EED), Health Technology Assessment (HTA) Database, Database of Abstracts of Reviews of Effects (DARE), and Cochrane Library as well as in Open Grey, Grey Literature Report, PsycEXTRA, ProQuest Theses and Dissertations, National Technical Information Service (NTIS), and Health Management Information Consortium (HMIC) database. Search terms/strings were developed based on 5 concepts: population/workplace; intervention; mental health/substance use-related disorders; work-related outcomes; and economic/financial-related outcomes (see page 7, Appendix for the list of concepts).

After the removal of duplicates, groups of two independent reviewers screened titles and abstracts and a third reviewer was assigned to resolve any disagreements, if/where necessary. Articles were excluded either because they examined the wrong population, did not focus on mental health and/or substance use, and/or did not include a full economic analysis. All reviews that met the inclusion criteria were also retrieved and used later during the snowballing process. Subsequently, all relevant full text articles were retrieved and screened by groups of two reviewers to confirm eligibility; a third reviewer was brought in, if/where necessary. Rayyan QCRI (<https://rayyan.qcri.org/>) was used to manage references and to screen titles and abstracts.

**Quality assessment**

All relevant studies were appraised for reporting and methodological quality by groups of two independent reviewers, with a third reviewer assigned to resolve any disagreements. We used the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist to ascertain reporting quality. This checklist includes 24 items, which are equally weighted8 (a copy of the checklist can be found on pages 8-10, Appendix). The following categories were used to score each checklist item: yes (adequately reported), partial (partially reported), no (not reported), and not applicable. The Quality of Health Economic Studies (QHES) checklist was used to ascertain methodological quality,9 as it has good construct validity and reliability,10 and is easy to use.11 This checklist includes 16 items, answered as yes or no, and each item is assigned a weight ranging from 1 to 9, depending on its importance in an economic analysis/evaluation. The sum of the weights ranges between 0 (extremely poor quality) and 100 (excellent quality). The QHES checklist states that researchers should employ yes/no responses, suggesting that each item should only be scored with full or no points at all. Nonetheless, some studies have employed partial scoring.12 We found that the all-or-nothing approach was not reasonable for checklist items that included more than one question. Therefore, we decided to implement the partial scoring method used by Yong and Shafie (2014), which was further modified to address some additional limitations[[1]](#footnote-1) (a copy of the modified checklist can be found on pages 11-13, Appendix ). The methodological quality of each study was assessed by applying the four categories suggested by Ofman et al., 20039 and Spiegel et al., 2004:13 extremely poor quality (QHES scores: 0–24), poor quality (QHES scores: 25–49), fair quality (QHES scores: 50–74), and high quality (QHES scores: 75–100). Ultimately, the overall quality of each study was based on the QHES checklist given that most studies performed well on the CHEERS checklist. Both checklists were tested on a sample of six studies by two independent reviewers who subsequently met to discuss how well each checklist captured relevant aspects of the study. Once data quality was completed, the reviewers met to discuss consensus on the final scores; a third reviewer was assigned to resolve any disagreements.

**Data extraction**

Data extraction was only performed on studies deemed high quality as it was felt that evidence synthesis should be based on studies carried out in accordance with the required elements of a proper economic analysis/evaluation. The data extraction tool was developed by the research team and based on the Cochrane good practice data extraction form. It included the following categories: general information (title, author, and year of publication; study quality, based on the QHES score; country of study; setting/industry; firm size; study population); details of the intervention (study design; description of intervention(s); comparator; type of intervention); economic analysis (perspective and type of economic analysis undertaken); outcomes (mental health/substance use disorder(s), work-related outcome(s), economic/financial outcome(s)), and main findings. The tool was first tested on a random sample of six studies by groups of two independent reviewers who subsequently met to discuss how well the data extraction tool captured the relevant data elements; refinements were then made if/where required. Once the tool was finalised, groups of two independent reviewers undertook data extraction on all studies and then met to discuss consensus on the relevant information to be extracted; a third reviewer was assigned to resolve any disagreements.

**Data analysis/evidence synthesis**

The studies included covered interventions that focused on a variety of mental health and substance use disorders, in different industries and countries. Given the heterogeneity of studies, we were not able to undertake a meta-analysis. Hence, we undertook a narrative synthesis supplemented by a quantitative analysis on high quality studies only, stratified by disorder, where possible. The existing evidence was synthesised using Slavin’s best evidence synthesis approach,14,15 which compares evidence from different sources and bases the strength of a relationship between variables on the quality, quantity, and consistency of evidence available. It has been used in previous work on this topic.16 We ranked evidence based on a 4-level scale: strong(three or more studies must report consistent findings), moderate (two studies must report consistent findings), limited (findings are only available from one study), and mixed evidence (findings from existing studies are contradictory). Each stratum of studies was evaluated against the criterion for the highest level; if it was not met, the criterion for the next highest level was considered. The process continued through each level of evidence until the pre-specified criterion was met.

The review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and was registered with PROSPERO, number CRD42019137421.

**Results**

***Study selection***

After all citations were merged and duplicates were removed, our search produced 11,018 unique records, of which 708 full texts were assessed, and 56 studies were ultimately retained (see Figure 1 and page 14, Appendix).

The majority of interventions focused on depression or smoking or multiple mental health disorders. Most studies were undertaken in the US, followed by the Netherlands. A substantial number of studies did not specify the sector and many did not state firm size. A large portion of studies included a randomised control trial and/or modelling, and evaluated either secondary or tertiary interventions. Most studies looking at depression focused on cognitive behavioural therapy (CBT), while studies on smoking typically examined smoking cessation drug coverage. Most studies adopted an employer perspective and, to a lesser extent, both employer and societal perspectives; the economic analysis typically employed was a cost-benefit analysis. Regarding workplace-related outcomes, most studies focused on absenteeism, followed by presenteeism. The main economic/financial outcomes reported were either return on investment, net monetary benefit or incremental cost-effectiveness ratio.

***Quality assessment and data extraction***

Detailed information on the quality assessment can be found on pages 15-20, Appendix. In short, based on the QHES checklist scores, we found 23 studies of high quality,17-40 25 of fair quality,41-65 7 of poor quality,66-72 and 1 of extremely poor quality.73 Data were extracted on all studies deemed high quality; see Tables 1A and 1B.

***Evidence synthesis***

Evidence synthesis was undertaken by disorder. Given the small number of studies, the heterogeneity of interventions and the availability of information, we were not able to synthesise the evidence by firm size, industry/sector or country. Among the high quality studies, we found 5 studies, which examined depression, 11 studies, which examined multiple outcomes, such as post-traumatic stress disorder, depression, anxiety, stress, or mental health in general, 6 studies, which examined smoking, and 1 study, which examined alcohol (Table 2).

*Mental health disorders: depression.* We found moderate evidence that workplace interventions, which include CBT and those, which include CBT and care management (i.e., increased coordination, regular follow up, and management of the patient’s care plan) are both cost saving to treat depression among workers. In both cases, returns on investment were greater than zero, thus providing employers a net return (i.e., total returns exceed total costs). In some cases, CBT interventions with care management provided higher returns than those without. For example, based on the existing literature, for CBT interventions without care management, one study found a return on investment of $1.78 (95% CI: -$24.66 – $28.63) per employee after 1 year,24 while another study found a very modest return on investment of $0.25 (no confidence intervals were reported) after 27 months.19 On the other hand, for every dollar invested in workplace CBT interventions *with* care management, studies found a larger return on investment, varying between $0.39 (no confidence intervals were reported)25 and $3.35 (95% CI: $0.42 – $5.53)36 per employee after 1 year. Some studies found CBT to be cost-effective as well. For example, one study found that CBT alone compared to pharmacotherapy was cost-effective,19 while another found that CBT with care management compared to usual care (i.e., care that would occur in the absence of treatment) was cost-effective.17 Thus, we found limited evidence that interventions that included CBT or CBT with care management were cost-effective. We also found limited evidence that CBT with pharmacotherapy, care management alone and pharmacotherapy coverage alone were cost saving to treat depression.17,19

*Mental health disorders: other.* All other studies examining mental health disorders were too heterogeneous to synthesise and, therefore, were organised by type of intervention: primary and secondary interventions, and tertiary interventions. Given few studies, the evidence for primary and secondary interventions was limited. For example, one study from Germany found limited evidence that internet-based management interventions were cost saving and cost-effective to alleviate stress among employees at a health insurance firm.29 Regarding tertiary interventions, we found strong evidence that, to reduce mental health-related sick leave (due to depression, stress and/or anxiety) and encourage return to work, including regular and active involvement of occupational physicians and nurses in workplace interventions is cost saving and cost-effective.20,26,35 All three studies undertook an economic evaluation alongside a randomised control trial. One study reported a modest return on investment of $0.87 (95% CI: -$0.87 – $1.34) per employee after 1 year in the Netherlands,20 as a result of reduced sick leave days due to depression, anxiety and stress; another study examining an intervention at a small and medium firm in the Netherlands found a more attractive return on investment of $10.63 (no confidence intervals were reported).26 The third study, undertaken in Finland, did not provide sufficient data to estimate a return on investment but found a cost saving of $36.62-$55.96 per 1-day reduction in sickness absence due to depression and stress.35 We found limited evidence for all other tertiary interventions.

*Substance use: tobacco.* We found moderate evidence that, to address smoking cessation, varenicline is more cost saving and cost-effective compared to bupropion. For example, one study found that, compared to bupropion, for every dollar invested in varenicline, employers received $0.84 per employee after 1 year;39 another study found substantially higher returns on investment – $4.00 after 2 years, $8.80 after 5 years, and $16.70 after 10 years, per employee (no confidence intervals were reported).27 In addition, we found moderate evidence that, to address smoking cessation, bupropion is more cost saving and cost-effective compared to nicotine replacement therapy. One study found that, compared with nicotine replacement therapy, for every dollar spent on bupropion, employers received $2.07 per employee after 1-year (no confidence intervals were reported).28 The other study did not provide enough information to calculate the return on investment.37 Finally, we found moderate evidence that, to address smoking cessation in the workplace, brief (i.e., less than 10 minutes) counselling is cost saving and cost-effective. While one study found a return on investment of $2.92 (95% CI: $0.84 – $8.12) after 1 year for every dollar spent,34 another study found a return on investment of $1.19 (no confidence intervals were reported) per female employees and $5.08 (no confidence intervals were reported) per male employees over 10 years.18 We found limited evidence for other smoking cessation-related interventions.

*Substance use: alcohol.* We found limited evidence that alcohol use prevention and treatment programs38 are cost saving and cost-effective to address alcohol problems among workers.

**Discussion**

The goal of this review was to provide a comprehensive list of the highest yielding and most cost-effective workplace mental health and substance use interventions. We found 56 relevant studies, less than half of which were considered high quality. Our review suggests that workplace interventions to prevent or treat depression are cost saving (though not always cost-effective), return-to-work interventions to address mental health-related sick leave and encourage return to work are both cost saving and cost-effective, and pharmacotherapy and counselling for smoking cessation in the workplace provide cost savings and is cost-effective.

Our findings are in line with other reviews. Hamberg-van Reenen et al. (2012) found a small number of relevant studies, most of which were of poor quality. They found that worksite interventions, which prevented or treated mental health problems, might be cost-effective, while return-to-work interventions, which included a full economic evaluation aimed at employees with depression, did not seem to be cost-effective. We found that interventions with CBT aimed at employees with depression are cost saving but not always cost-effective, while regular and active involvement of occupational health professionals in mental health-related return-to-work interventions is both cost saving and cost-effective. Subsequently, Nogues and Finucan (2018) updated the Hamberg-van Reenen et al. (2012) review, while critically appraising the literature on the potential barriers among workers participating in such interventions, such as mental illness-related stigma and disclosure in the workplace. They found that investing in workplace mental health treatment and tertiary prevention interventions tends to yield a positive return on investment for employers of 1,000 or more, in short time horizons and with employees’ participation rates below 50%. However, the authors did not find any studies, which included an economic evaluation of workplace interventions with a focus on workplace accommodation or stigma. We also found that investing in workplace mental health treatment and tertiary prevention interventions provides a positive return on investment but also no studies with a focus on stigma.

There have also been reviews on economic evaluations of workplace polices for smoking cessation.74,75 A rapid review found that, from the employer’s perspective, bupropion is a cost-beneficial smoking cessation intervention, regardless of whether counselling was provided.74 Moreover, this review found that nicotine replacement therapy with a pharmacist’s smoking cessation consultation and patient participation in a formal smoking cessation programme provided the greatest net benefit for employers. Our review confirms these findings. We also found that varenicline was a cost-effective option for smoking cessation, in line with other work.76

All studies were undertaken in high-income countries, in particular in the US and the Netherlands. It is important to note there is variability in community access to routine mental health and substance use interventions across countries. For example, in some countries, such as the UK, CBT is readily available through government-funded programs, which might help decrease the need for workplace CBT programs for depression. However, in jurisdictions where this is not provided by the public health care system or those without universal healthcare coverage, there may still be some advantages in providing access to CBT via the workplace. Moreover, alongside the implementation of workplace interventions, it is also important that internal organisational changes occur to ensure workplace mental health initiatives are successful. The vast majority of studies examined in this review did not describe any organisational change that occurred internally to help facilitate change. However, other work has found that senior and mid-level management must be actively involved to foster a sense of comfort amongst employees in bringing forward their mental health concerns;77-80 managers need training in recognising and providing support for staff with mental health concerns;81-84 companies need to identify specific organisational needs and goals before taking on new policies;78,85 and workplace cultures need to respect employees’ mental health and wellbeing.86,87 We did not find any studies that examined the return on investment or cost-effectiveness related to these changes. Finally, it is also important to ensure there are policies in place that address workplace bullying as this could increase the risk of depression, anxiety or substance use amongst workers, and override the effectiveness of well-intentioned workplace initiatives.

This review only focused on interventions delivered in a workplace. However, some initiatives have also been rolled out at the jurisdiction level (i.e., state-wide). For example, one study examined the impact of a state-wide smoke-free workplace policy in Minnesota, US, and found that smoke-free workplace policies were more cost-effective than free nicotine replacement therapy programs.88 Another study examined the impact of a suicide prevention strategy on the economic cost of suicide in the construction industry in New South Wales, Australia.89 The authors estimated that the strategy would result in 0.4 fewer deaths by suicide and 5.93 episodes of self-harm per year, and annual cost savings of about 3.66 million AUD.

Despite a comprehensive search of the literature, we did not find any studies that examined other mental health/substance use disorders in the workplace, such as self-harm/suicidal ideation, problem gambling, opioids and cannabis. The latter two are likely to gain further importance in the workplace given the current opioid epidemic in many developed countries and the legalisation of cannabis in Canada, Uruguay, and some states in the US.

Generally, most studies included the CHEERS checklist items. However, there were a few items on the QHES checklist where most studies were either lacking, such as the inclusion of subgroup analyses, the discussion around potential bias in data sources and analysis, and statistical/sensitivity analyses and discussion around uncertainty, or where the analysis could be improved upon, such as the choice of time horizon to account for the various costs and outcomes (very few studies looked beyond one year) and the use of an appropriate discount rate. Moreover, many studies only estimated return on investment; while this measure tends to be preferred by employers, it fails to account for many aspects of health consequences.89 The incremental cost-effectiveness ratio addresses this limitation and thus is preferred.90 Overall, most studies adopted the employer perspective, which is in line with the recommended approach when undertaking economic evaluations of workplace interventions.89

This review is not without limitations. Given the heterogeneous nature of the studies, it was challenging to synthesise the literature, namely by firm size, industry/sector or country. To assess the quality of the studies, we used the CHEERS and QHES checklists. Although both have been used in previous systematic reviews, these checklists have drawbacks. For example, the CHEERS checklist provides equal weighting for all items (which led to the use of a second checklist),8 whereas the application of the QHES checklist requires some interpretation by researchers.11 Moreover, although the cut-off scores to categorise studies were based on prior work, other definitions may be possible, which could have changed our findings. Finally, despite going to great lengths to ensure our review was comprehensive, we cannot guarantee that some relevant studies were missed, namely studies from the grey literature. Nonetheless, our study included a longer time frame and a more comprehensive search strategy than previous reviews; we considered literature published in other languages besides English; we searched many academic and grey literature databases; and we explored other potentially relevant sources of information, such as websites and content experts. As a result, our review not only captured all studies included in previous reviews but also included studies not captured elsewhere. Our review also included studies with a focus on workplace substance use, which has not been included in previous work.

These findings will be of value to employers, policy makers in the workplace and health fields and other interested stakeholders looking for solutions to address workplace mental health/substance use. This work will also be relevant to researchers undertaking economic evaluations of workplace interventions focusing on mental health and/or substance use. Despite a reasonable number of high quality studies, there are still areas that would benefit from improvement, such as the consideration of subgroup analyses, examination of longer (and more appropriate) time horizons to account for costs and outcomes, inclusion of statistical and sensitivity analyses and discussion around uncertainty, and consideration of potential for bias in data sources and analyses. Moreover, future work should seek to understand the risk factors associated with poor workplace mental health, such as stigma and workplace bullying, as well as organisational change required to implement successful workplace interventions, such as endorsement and support from senior and mid-level management.

**Contributors**

CdO and JR conceived and designed the study. CdO drafted the original protocol. EC and BB selected the articles and EC, RAK, MJ and BB undertook quality assessment and extracted the data. CdO wrote the first draft of the manuscript. All authors provided comments and critical revisions on drafts of the manuscript.

**Declaration of interests**

We declare no competing interests

**Data sharing**

We are happy to share all data collected for this article, including data extraction tables. These data will be available from the publication date. Please contact the corresponding author if you would like to see any data that are not included in the article or appendix.

**Acknowledgments**

This analysis represents independent work commissioned and funded by the Centre for Addiction and Mental Health Foundation. The views expressed are those of the authors and not necessarily those of the Centre for Addiction and Mental Health Foundation. We acknowledge the help of Srinivasan Govindaraj and Shazmeera Qadri in reviewing the titles and abstracts and undertaking quality assessment using the CHEERS checklist.

**References**

1. World Health Organization. Global Health Estimates 2016: Disease burden by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva: World Health Organization; 2018. [cited 2019 Aug 15]. Available from: <https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html>
2. Bloom DE, Cafiero ET, Jané-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S, Feigl AB, Gaziano T, Mowafi M, Pandya A, et al. The global economic burden of noncommunicable diseases. Geneva: World Economic Forum; 2011.
3. Mental Health Commission of Canada. Why investing in mental health will contribute to Canada’s economic prosperity and to the sustainability of our health care system. [Internet]. Ottawa: Mental Health Commission of Canada; 2014 [cited 2019 Aug 15]. Available from: <https://www.mentalhealthcommission.ca/English/media/3104>
4. Roberts G, Grimes K. Return on investment-mental health promotion and mental illness prevention. [Internet]. London: University of Western Ontario; 2011 Mar 31 [cited 2019 Aug 15]. Available from: <https://cpa.ca/docs/File/Practice/roi_mental_health_report_en.pdf>
5. Evans-Lacko S, Knapp M. Global patterns of workplace productivity for people with depression: absenteeism and presenteeism costs across eight diverse countries. Soc Psychiatry Psychiatr Epidemiol. 2016;51(11):1525-37.
6. Hamberg-van Reenen HH, Proper KI, van den Berg M. Worksite mental health interventions: a systematic review of economic evaluations. Occup Environ Med. 2012;69(11):837-45.
7. Nogues S, Finucan J. Economic Evaluations of Workplace Mental Health Interventions: A Critical Review. Can J Adm Sci. 2018;35(4):551-62.
8. Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, et al. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. BMJ. 2013;346:f1049.
9. Ofman JJ, Sullivan SD, Neumann PJ, Chiou CF, Henning JM, Wade SW, et al. Examining the value and quality of health economic analyses: implications of utilizing the QHES. J Manag Care Pharm. 2003;9(1):53-61.
10. Au F, Prahardhi S, Shiell A. Reliability of two instruments for critical assessment of economic evaluations. Value Health. 2008;11(3):435-39.
11. Watts RD, Li IW. Use of checklists in reviews of health economic evaluations, 2010 to 2018. Value Health. 2019;22(3):377-82.
12. Yong YV, Shafie AA. Economic evaluation of enhanced asthma management: a systematic review. Pharm Pract. 2014;12(4):493.
13. Spiegel BM, Targownik LE, Kanwal F, Derosa V, Dulai GS, Gralnek IM, et al. The quality of published health economic analyses in digestive diseases: a systematic review and quantitative appraisal. Gastroenterol. 2004;127(2):403-11.
14. Slavin RE. Best-evidence synthesis: an alternative to meta-analytic and traditional reviews. Educ Res. 1986;15(9):5-11.
15. Slavin RE. Best evidence synthesis: an intelligent alternative to meta-analysis. J Clin Epidemiol. 1995;48(1):9-18.
16. Tompa E, Dolinschi R, de Oliveira C, Irvin E. A systematic review of occupational health and safety interventions with economic analyses. J Occup Environ Med. 2009;51(9):1004-23.
17. Wang PS, Patrick A, Avorn J, Azocar F, Ludman E, McCulloch J, et al. The costs and benefits of enhanced depression care to employers. Arch Gen Psychiatry. 2006;63(12):1345-53.
18. Weng SF. The health and economic costs of smoking in the workforce [dissertation on the Internet]. Nottingham: University of Nottingham; 2013 [Cited 2019 Aug 12]. Available from: <http://eprints.nottingham.ac.uk/27653/>
19. Evans-Lacko S, Koeser L, Knapp M, Longhitano C, Zohar J, Kuhn K. Evaluating the economic impact of screening and treatment for depression in the workplace. Eur Neuropsychopharmacol. 2016;26(6):1004-13.
20. Rebergen DS, Bruinvels DJ, van Tulder MW, van der Beek AJ, van Mechelen W. Cost-effectiveness of guideline-based care for workers with mental health problems. J Occup Environ Med. 2009;51(3):313-22.
21. van Oostrom SH, Heymans MW, de Vet HC, van Tulder MW, van Mechelen W, Anema JR. Economic evaluation of a workplace intervention for sick-listed employees with distress. Occup Environ Med. 2010;67(9):603-10.
22. Lavelle TA, Kommareddi M, Jaycox LH, Belsher B, Freed MC, Engel CC. Cost-effectiveness of collaborative care for depression and PTSD in military personnel. Am J Manag Care. 2018;24(2):91-8.
23. Noben C, Smit F, Nieuwenhuijsen K, Ketelaar S, Gartner F, Boon B, et al. Comparative cost-effectiveness of two interventions to promote work functioning by targeting mental health complaints among nurses: pragmatic cluster randomised trial. Int J Nurs Stud. 2014;51(10):1321-31.
24. Geraedts AS, van Dongen JM, Kleiboer AM, Wiezer NM, van Mechelen W, Cuijpers P, et al. Economic evaluation of a web-based guided self-help intervention for employees with depressive symptoms: results of a randomized controlled trial. J Occup Environ Med. 2015;57(6):666-75.
25. Lo Sasso AT, Rost K, Beck A. Modeling the impact of enhanced depression treatment on workplace functioning and costs: a cost-benefit approach. Med Care. 2006;44(4):352-8.
26. Lokman S, Volker D, Zijlstra-Vlasveld MC, Brouwers EP, Boon B, Beekman AT, et al. Return-to-work intervention versus usual care for sick-listed employees: health-economic investment appraisal alongside a cluster randomised trial. BMJ Open. 2017;7(10):e016348.
27. Halpern MT, Dirani R, Schmier JK. Impacts of a smoking cessation benefit among employed populations. J Occup Environ Med. 2007a;49(1):11-21.
28. Nielsen K, Fiore MC. Cost-benefit analysis of sustained-release bupropion, nicotine patch, or both for smoking cessation. Prev Med. 2000;30(3):209-16.
29. Ebert DD, Kahlke F, Buntrock C, Berking M, Smit F, Heber E, et al. A health economic outcome evaluation of an internet-based mobile-supported stress management intervention for employees. Scand J Work Env Hea. 2018;44(2):171-82.
30. Hengel KMO, Bosmans JE, Van Dongen JM, Bongers PM, Van der Beek AJ, Blatter BM. Prevention program at construction worksites aimed at improving health and work ability is cost-saving to the employer: results from an rct. Am J Ind Med. 2014;57(1):56-68.
31. Dewa CS, Hoch JS. Estimating the net benefit of a specialized return-to-work program for workers on short-term disability related to a mental disorder: an example exploring investment in collaborative care. J Occup Environ Med. 2014;56(6):628-31.
32. Dewa CS, Hoch JS, Carmen G, Guscott R, Anderson C. Cost, effectiveness, and cost-effectiveness of a collaborative mental health care program for people receiving short-term disability benefits for psychiatric disorders. Can J Psychiatry. 2009;54(6):379-88.
33. Arends I, Bultmann U, van Rhenen W, Groen H, van der Klink JJ. Economic evaluation of a problem solving intervention to prevent recurrent sickness absence in workers with common mental disorders. PLoS One. 2013;8(8):e71937.
34. Javitz HS, Swan GE, Zbikowski SM, Curry SJ, McAfee TA, Decker D, et al. Return on investment of different combinations of bupropion SR dose and behavioral treatment for smoking cessation in a health care setting: an employer's perspective. Value Health. 2004;7(5):535-43.
35. Taimela S, Justen S, Aronen P, Sintonen H, Laara E, Malmivaara A, et al. An occupational health intervention programme for workers at high risk for sickness absence. Cost effectiveness analysis based on a randomised controlled trial. Occup Environ Med. 2008;65(4):242-8.
36. Goorden M, Vlasveld MC, Anema JR, van Mechelen W, Beekman ATF, Hoedeman R, et al. Cost-utility analysis of a collaborative care intervention for major depressive disorder in an occupational healthcare setting. J Occup Rehabil. 2014;24(3):555-62.
37. Halpern MT, Dirani R, Schmier JK. The cost effectiveness of varenicline for smoking cessation. Manag Care Interface. 2007b;20(10):18-25.
38. Quanbeck A, Lang K, Enami K, Brown RL. A cost-benefit analysis of Wisconsin's screening, brief intervention, and referral to treatment program: adding the employer's perspective. WMJ. 2010;109(1):9-14.
39. Jackson KC, Nahoopii R, Said Q, Dirani R, Brixner D. An employer-based cost-benefit analysis of a novel pharmacotherapy agent for smoking cessation. J Occup Environ Med. 2007;49(4):453-60.
40. Noben C, Evers S, Nieuwenhuijsen K, Ketelaar S, Gartner F, Sluiter J, et al. Protecting and promoting mental health of nurses in the hospital setting: Is it cost-effective from an employer's perspective? Int J Occup Med Environ Health. 2015;28(5):891-900.
41. Yu S, Glozier N. Mentally healthy workplaces in NSW-A return-on-investment study. [Internet]. Sydney: SafeWork NSW; 2017 Oct 19 [cited 2019 Aug 12]. Available from: <https://www.safework.nsw.gov.au/__data/assets/pdf_file/0011/320132/Mentally-healthy-workplaces-A-return-on-investment-study-August-2017-SW08735.pdf>
42. Hitt D, Tahir T, Davies L, Lanka S, Sin C, Naya K, et al. Economic assessment of a workplace cognitive behaviour therapy service. Ment Health Pract. 2016;19:25-31.
43. Phillips R, Schneider J, Molosankwe I, Leese M, Foroushani PS, Grime P, et al. Randomized controlled trial of computerized cognitive behavioural therapy for depressive symptoms: effectiveness and costs of a workplace intervention. Psychol Med. 2014;44(4):741-52.
44. Boyd R, Hunt A, Ortiz R. An economic analysis of workplace interventions that promote mental wellbeing in the workplace. [Internet]. London: The National Institute for Health and Care Excellence; 2007 [cited 2019 Aug 12]. Available from: <https://www.nice.org.uk/guidance/ph22/evidence/economic-analysis-of-workplace-interventions-that-promote-mental-wellbeing-in-the-workplace-67280509>
45. Miller TR, Zaloshnja E, Spicer RS. Effectiveness and benefit-cost of peer-based workplace substance abuse prevention coupled with random testing. Accid Anal Prev. 2007;39(3):565-73.
46. Callander EJ, Lindsay DB, Scuffham PA. Employer benefits from an early intervention program for depression: a cost-benefit analysis. J Occup Environ Med. 2017;59(3):246-9.
47. Matrix Insight. Economic analysis of workplace mental health promotion and mental disorder prevention programmes and of their potential contribution to EU health, social and economic policy objectives. [Internet]. The European Union: Executive Agency for Health and Consumers. 2012 Nov [cited 2019 Aug 12]. Available from: <http://www.mentalhealthpromotion.net/?i=portal.en.enmhp-news.2900>
48. Henke RM, Head MA, Kent KB, Goetzel RZ, Roemer EC, McCleary K. Improvements in an organization's culture of health reduces workers' health risk profile and health care utilization. J Occup Environ Med. 2019;61(2):96-101.
49. Lerner D, Adler D, Hermann RC, Chang H, Ludman EJ, Greenhill A, et al. Impact of a work-focused intervention on the productivity and symptoms of employees with depression. J Occup Environ Med. 2012;54(2):128-35.
50. Milligan-Saville JS, Tan L, Gayed A, Barnes C, Madan I, Dobson M, et al. Workplace mental health training for managers and its effect on sick leave in employees: a cluster randomised controlled trial. Lancet Psychiat. 2017;4(11):850-8.
51. Mehay S, Webb NJ. Workplace drug prevention programs: does zero tolerance work? Appl Econ. 2007;39(21):2743-51.
52. Iijima S, Yokoyama K, Kitamura F, Fukuda T, Inaba R. Cost-benefit analysis of comprehensive mental health prevention programs in Japanese workplaces: a pilot study. Ind Health. 2013;51(6):627-33.
53. Lerner D, Adler DA, Rogers WH, Chang H, Greenhill A, Cymerman E, et al. A randomized clinical trial of a telephone depression intervention to reduce employee presenteeism and absenteeism. Psychiat Serv. 2015;66(6):570-7.
54. KPMG. Investing to save-the economic benefits for Australia of investment in mental health reform. [Internet]. Canberra: Mental Health Australia; 2018 May [cited 2019 Aug 12]. Available from: <https://mhaustralia.org/publication/investing-save-kpmg-and-mental-health-australia-report-may-2018>
55. Birnbaum HG, Cremieux PY, Greenberg PE. Management of major depression in the workplace: impact on employee work loss. Dis Manag Health Out. 2000;7(3):163-71.
56. Hargrave GE, Hiatt D. The EAP treatment of depressed employees: implications for return on investment. J Workplace Behav Health. 2005;19(4):39-49.
57. McCraty R, Atkinson M, Lipsenthal L, Arguelles L. New hope for correctional officers: an innovative program for reducing stress and health risks. Appl Psychophys Biof. 2009;34(4):251-72.
58. PwC. Creating a mentally healthy workplace-return on investment analysis. [Internet]. Sydney: Australian Government National Mental Health Commission; 2014 Mar [cited 2019 Aug 12]. Available from: <https://www.headsup.org.au/docs/default-source/resources/beyondblue_workplaceroi_finalreport_may-2014.pdf>
59. Osilla KC, dela Cruz E, Miles JN, Zellmer S, Watkins K, Larimer ME, et al. Exploring productivity outcomes from a brief intervention for at-risk drinking in an employee assistance program. Addict Behav. 2010;35(3):194-200.
60. Bittman B, Bruhn KT, Stevens C, Westengard J, Umbach PO. Recreational music-making: a cost-effective group interdisciplinary strategy for reducing burnout and improving mood states in long-term care workers. Adv Mind Body Med. 2003;19(3-4):4-15.
61. Makrides L, Smith S, Allt J, Farquharson J, Szpilfogel C, Curwin S, et al. The Healthy LifeWorks Project: a pilot study of the economic analysis of a comprehensive workplace wellness program in a Canadian government department. J Occup Environ Med. 2011;53(7):799-805.
62. Vogt J, Leonhardt J, Pennig S. Critical incident stress management in air traffic control and its benefits. Air Traffic Control Q. 2007;15:127-56.
63. Goetzel RZ, Tabrizi M, Henke RM, Benevent R, Brockbank CV, Stinson K, et al. Estimating the return on investment from a health risk management program offered to small Colorado-based employers. J Occup Environ Med. 2014;56(5):554-60.
64. Musich S, McCalister T, Wang S, Hawkins K. An evaluation of the Well at Dell health management program: health risk change and financial return on investment. Am J Health Promot. 2015;29(3):147-57.
65. Jerdén L, Lindholm L, Weinehall L. Cost-effectiveness of a personal health document in different distribution settings. Health Promot J Aust. 2008;19(2):125-31.
66. Knapp M, McDaid D, Parsonage M. Mental health promotion and mental illness prevention: The economic case [Internet]; London: Department of Health. 2011 [cited 22 August 2019]. Available from: <http://eprints.lse.ac.uk/39300/1/Mental_health_promotion_and_mental_illness_prevention%28author%29.pdf>
67. Bedell W, Kaszkin-Bettag M. Coherence and health care cost-RCA actuarial study: a cost-effectiveness cohort study. Altern Ther Health Med. 2010;16(4):26-31.
68. Vaananen-Tomppo I, Janatuinen E, Tornqvist R. All well at work? Evaluation of workplace-based early rehabilitation in the Finnish State administration. Int J Rehabil Res. 2001;24(3):171-80.
69. Morneau Shepell. EAP Improves Health Status and Productivity, and Demonstrates a Positive ROI [Internet]; Toronto: Morneau Shepell. 2011 [cited 22 August 2019]. Available from: <http://www.shepellfgi.com/pdf/Report_Impact_on_Health_and_Prod_EN.PDF>
70. Halpern DF. How time-flexible work policies can reduce stress, improve health, and save money. Stress Health. 2005;21(3):157-68.
71. McDaid D, Park Al, Knapp M. Commissioning Cost-Effective Services for Promotion of Mental Health and Wellbeing and Prevention of Mental Ill-Health [Internet]; London: Public Health England. 2017 [cited 22 August 2019]. Available from: <http://www.lse.ac.uk/business-and-consultancy/consulting/assets/documents/commissioning-cost-effective-services-for-promotion-of-mental-health-and-wellbeing-and-prevention-of-mental-ill-health.pdf>
72. Kono Y, Hosaka T. Economic evaluation of an occupational mental health program: Decision analysis of salary compensation and medical expenses. Asian Pacific Journal of Disease Management. 2008;2(3):77-82.
73. d'Ettorre G. Job stress and needlestick injuries: which targets for organizational interventions? Occup Med-Oxford. 2016;66(8):678-80.
74. York Health Economics Consortium. Net monetary benefit [Internet]; 2016 [cited 22 August 2019]. Available from: <https://www.yhec.co.uk/glossary/net-monetary-benefit/>
75. Kahende JW, Loomis BR, Adhikari B, Marshall L. A review of economic evaluations of tobacco control programs. Int J Environ Res Public Health. 2009;6(1):51-68.
76. Faulkner M. Smoking cessation: an economic analysis and review of varenicline. Clinicoecon Outcomes Res. 2009;1:25-34.
77. Park KO, Wilson MG, Lee MS. Effects of social support at work on depression and organizational productivity. Am J Health Behav. 2004;28(5):444-55.
78. Brown SK, Bain P, Freeman M. Employee perceptions of alcohol and drug policy effectiveness: Policy features, concerns about drug testing, and the key role of preventative measures. Drug Educ Prev Polic. 2008;15(2):145-60.
79. Van der Heijden BI, Mulder RH, Konig C, Anselmann V. Toward a mediation model for nurses' well-being and psychological distress effects of quality of leadership and social support at work. Medicine. 2017;96(15):e6505.
80. Evans-Lacko S, Knapp M. Is manager support related to workplace productivity for people with depression: a secondary analysis of a cross-sectional survey from 15 countries. BMJ Open. 2018;8(6):e021795.
81. Richmond R, Kehoe L, Heather N, Wodak A. Evaluation of a workplace brief intervention for excessive alcohol consumption: the workscreen project. Prev Med. 2000;30(1):51-63.
82. Grant AM, Curtayne L, Burton G. Executive coaching enhances goal attainment, resilience and workplace well-being: a randomised controlled study. J Posit Psychol. 2009;4(5):396-407.
83. Thompson AH, Jacobs P, Moffatt J, Waye A. Delivery and Evaluation of a Mental Health Promotion Intervention for Alberta Workplace Supervisors and Managers. [Internet]. Edmonton: Institute of Health Economics; 2013 Sept [cited 2019 August 12]. Available from: <https://www.ihe.ca/publications/delivery-and-evaluation-of-a-mental-health-promotion-intervention-for-alberta-workplace-supervisors-and-managers>
84. Stansfeld SA, Kerry S, Chandola T, Russell J, Berney L, Hounsome N, et al. Pilot study of a cluster randomised trial of a guided e-learning health promotion intervention for managers based on management standards for the improvement of employee well-being and reduction of sickness absence: GEM Study. BMJ Open. 2015;5(10):e007981.
85. Beyond Blue. Developing a Workplace Mental Health Strategy-a how-to guide for organizations. [Internet]. Hawthorn: Beyond Blue; 2018 [cited 22 August 2019]. Available from: <https://www.headsup.org.au/docs/default-source/resources/393615_1117_bl1833_acc-2.pdf?sfvrsn=f5cf264d_4>
86. Burton WN, Conti DJ. Depression in the workplace: the role of the corporate medical director. J Occup Environ Med. 2008;50(4):476-81.
87. Ong MK, Glantz SA. Free nicotine replacement therapy programs vs implementing smoke-free workplaces: a cost-effectiveness comparison. Am J Public Health. 2005;95(6):969-75.
88. Doran CM, Ling R, Gullestrup J, Swannell S, Milner A. The impact of a suicide prevention strategy on reducing the economic cost of suicide in the new south wales construction industry. Crisis. 2016;37(2):121-9.
89. Tompa E, Culyer A, Dolinschi R. Economic evaluation of interventions for occupational health and safety: Developing good practice. Oxford: Oxford University Press; 2008.
90. Neumann P, Sanders G, Russell L, Siegel J, Ganiats T. Cost-effectiveness in health and medicine. 2nd ed. Oxford: Oxford University Press; 2016.

1. For example, this occurred in one instance where we felt a mistake was made in the Yong and Shafie (2014) paper and in another instance where we included additional partial scoring. Based on a personal communication with one of the authors (Chiun Fang Chiou), it was suggested that, regardless of full or partial scoring, all raters should be aware of the scoring rule chosen and that inter-reliability consistency should be checked for the first several studies assessed. [↑](#footnote-ref-1)