Promoting workplace health and well-being through culture change. An evidence review.

Evidence review

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Table of Contents

List of tables

List of figures

Abbreviations

µg	microgram
ABW	Activity-Based Working
BJSQ	Brief Job Stress Questionnaire
BMI	body mass index
BOOT STRAP	BOOT Camp Survival Training for Navy Recruits—A Prescription
CLiAC	Clinical Leadership in Aged Care
cm	centimetre
COPSOQ	Copenhagen Psychosocial Questionnaire
COPSOQ 1	Copenhagen Psychosocial Questionnaire, version 1
dL	decilitre
ERI	Effort–Reward Imbalance
HR	human resources
HRB	Health Research Board
IT	information technology
IWBS	Individual Well-Being Score
JCQ	Job Content Questionnaire
Kg	kilogram
KOSS	Korean Occupational Stress Scale
L	litre
m2	square metre
MeSH	Medical Subject Headings
mg	milligram
mm Hg	millimetres of mercury
mmol	millimole
nmol	nanomole
N/A	not applicable
OECD	Organisation for Economic Co-operation and Development
PTSD	post-traumatic stress disorder
QWC	Quality Work Competence
R2MR	Road to Mental Readiness
RCT	randomised controlled trial
ROWE	Results-Only Work Environment

STAR	Support. Transform. Achieve. Results.
UK	United Kingdom
USA	United States of America
WES-R	Work Environment Scale-R

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Executive summary

Purpose

Under the auspices of Healthy Ireland, the Department of Health is leading the development of the Healthy Workplace Framework in partnership with the Department of Enterprise, Trade and Employment. The framework aims to drive engagement and identify effective approaches to health improvement in all workplaces. A review of the evidence (carried out by the Research Services Unit) and an extensive public consultation process by the Institute of Public Health identified a need for change in workplace culture. In particular, workers believed that organisational culture was one of the most important factors that could influence workplace health and well-being. This review will contribute to the development and implementation of the National Healthy Workplace Framework which is for all workplaces. This review will provide an evidence base to support this important work.

Research questions

This review will answer the following two questions:

1. Does a culture of health and well-being in an organisation influence the health and well-being of workers?
2. What factors drive this influence on health and well-being?

Methodology

No standardised definition for a 'workplace culture of health and well-being' currently exists. With a view to keeping a broad definition so that all relevant evidence is captured, Safeer and Allen's definition of workplace culture will be used for the purposes of this review: "a web of social influences that manifests itself in shared healthy beliefs and behaviors". The spheres of cultural influences developed by Safeer and Allen provided a conceptual map for cultural analysis, which also informed our inclusion criteria. These influences are: leadership support, touchpoints, peer support, social climate/morale, shared values, and norms.

In order to meet the inclusion criteria for this review, studies had to: focus on workers, employers, and managers; have a sample size of at least 50 participants; include an intervention (i.e. exposure to a culture of health and well-being influenced or introduced by the organisation); investigate an association or link between workplace culture and health and well-being outcomes; be carried out at a worksite or workplace at organisational level; include quantitative measures of relevant culture/health and well-being outcomes; have an experimental study design with a counterfactual; be conducted in an Organisation for Economic Co-operation and Development (OECD) member country; and be published in English since 2005.

Systematic searching of four databases was carried out in September 2020. Hand-searching of two journals (the *American Journal of Health Promotion* and the *Journal of Occupational and Environmental Medicine*) was also carried out. These strategies were supplemented by reference checking of included articles, citation chasing of articles that cited the included articles, and reference chasing of relevant systematic reviews. Search terms were developed based on Medical Subject Headings (MeSH) terms and appropriate keywords based on Safeer and Allen's definition of a workplace culture of health and well-being. Abstracts and full papers identified by the search were screened independently for eligibility by two researchers.

The data for each included study were extracted by a single reviewer into a bespoke extraction sheet in Microsoft Excel and verified independently by a second reviewer against a clean copy of the publication. Critical appraisal was carried out using the Effective Public Healthcare Panacea Project's Quality Assessment Tool for Quantitative Studies, with each study assessed by two independent reviewers. Following extraction, narrative synthesis was carried out, with studies grouped by intervention function: overarching health promotion interventions, physical activity interventions, leadership support interventions, flexible working interventions, emotional well-being interventions, participatory interventions, military mental health interventions, and unique interventions. Quantitative synthesis (e.g. meta-analysis) was not deemed to be feasible.

Findings

Sixty studies, reported across 60 articles, met the inclusion criteria. The vast majority of the studies were based in Europe (n=26) and North America (n=25).

Overarching health promotion interventions

Five studies examined large-scale, multicomponent health promotion programmes in workplaces with the aim of improving employee health and well-being by offering resources, guidance, and activities. Four of the studies demonstrated effects on a range of health and well-being outcomes, including improvements in health behaviours (e.g. dietary habits, physical activity, sedentary behaviour and tobacco use), as well as in physical and mental health measures. Three studies demonstrated effects on culture change measures, including bonding social capital, organisational support, and positive supervisor attitudes towards their role in health promotion. Two studies used statistical modelling to confirm that culture outcomes – specifically organisational support and positive supervisor attitudes – mediated the intervention effects on sickness absence and well-being.

Physical activity interventions

Five studies examined interventions to encourage physical activity. Four of these studies demonstrated effects on a range of health and well-being outcomes, including improvements in health behaviour (e.g. daily steps, activity level, and perceived changes in sitting) and well-being outcomes (e.g. vigour and workplace satisfaction). Four studies demonstrated effects on culture change measures, particularly around organisational and management support. None of the studies explored the statistical association between cultural change and health and well-being outcomes.

Leadership support interventions

Eight studies evaluated interventions that aimed to improve health and well-being through leadership support. Three of the studies demonstrated an improvement in health and well-being outcomes, including job satisfaction, self-rated health, emotional exhaustion, and stress. Six of the studies demonstrated improvements in cultural change outcomes, including line managers' attitudes and actions, transformational leadership, and job demands. Three studies confirmed a mediational relationship between cultural change and health and well-being outcomes.

Flexible working interventions

Ten studies evaluated interventions that aimed to improve health and well-being through flexible working arrangements. Nine studies demonstrated an improvement in health and well-being outcomes, particularly job satisfaction and psychological distress, and nine studies demonstrated an improvement on a wide range of cultural change measures, particularly schedule control and work–family conflict.

Seven studies confirmed a mediational relationship between a number of cultural change measures and health and well-being outcomes.

Emotional well-being interventions

Eight studies evaluated interventions that aimed to improve the emotional well-being of workers. Six demonstrated an improvement in health and well-being outcomes, particularly measures of sleep, depression, and stress. Seven demonstrated an impact on cultural change, including job demands and work–family conflict. Two studies confirmed that changes in sleep were mediated by schedule control and work–family conflict.

Participatory interventions

Twelve studies evaluated participatory interventions; these were interventions in which all participants were involved in making and carrying out decisions about the development of the intervention in order to ensure that it was tailored to their needs at the team, department, or organisation level. Six studies demonstrated a direct impact of the interventions on health and well-being measures, including burnout, job satisfaction, and self-rated health. Six studies demonstrated a direct impact of the interventions on a very large range of cultural change measures, including effort–reward imbalance, job control, and organisational change capacity. Six studies confirmed a mediational relationship between health and well-being outcomes and cultural change for a variety of measures.

Military mental health interventions

Six studies evaluated interventions that aimed to improve mental health outcomes in military recruits. Three studies evaluated the Battlemind training programme, with mixed and contradictory findings, although some studies found evidence for improvement in post-traumatic stress disorder (PTSD) and depression symptoms, with combat exposure identified as a modifier of the treatment effect. Three other interventions also demonstrated mixed findings, with some identified effects on help-seeking behaviour, depression, and stress. Cultural changes were demonstrated for measures of perceived group cohesion, social support, and class morale. One study confirmed that participants' perceptions of being embedded in a cohesive, healthy class contributed to reduced suicidal ideation and depression symptoms.

Unique interventions

Six additional studies evaluated interventions that were conceptually unique or distinct from the other groupings of interventions presented above. Three studies confirmed a mediational relationship between health and well-being outcomes and cultural change: perceived organisational support mediated the impact of exposure to timesizing on stress; the impact of implementing permanent teams on job satisfaction was mediated by the active involvement of middle managers; and perceived readiness for organisational change mediated the impact of physical redevelopment and shifts in operational and organisational processes on workplace satisfaction.

Cultural drivers

From the 26 studies that statistically examined mediation relationships, 10 cultural drivers (i.e. culture outcomes that were seen across intervention groups to act as a mediator between the intervention and the evaluated health and well-being outcomes) were identified. The cultural drivers were job control, information flow, job demands, organisational support, work climate, work–family conflict, supervisor support, line managers' attitudes and actions, justice of leadership, and feedback. Job control and work–family conflict were the most commonly reported cultural drivers, and were frequently linked to emotional exhaustion, sleep quality, and stress.

Conclusion

The studies included in this review demonstrate that health and well-being outcomes across a wide range of workplace interventions are mediated by workplace culture change. A number of key cultural drivers – job control, information flow, job demands, organisational support, work climate, work–family conflict, supervisor support, line managers' attitudes and actions, justice of leadership, and feedback – are seen to mediate the impact of workplace interventions. Workplace interventions can be designed with these cultural factors in mind in order to achieve health and well-being outcomes.

1 Introduction

Under the auspices of Healthy Ireland, the Department of Health has partnered with the Department of Enterprise, Trade and Employment to lead the development of the National Healthy Workplace Framework. The framework aims to drive engagement and identify effective approaches to health improvement in all workplaces.

In order to inform this framework, a review of the evidence was carried out by the Research Services Unit, and an extensive consultation process was coordinated by the Institute of Public Health.[1] The Health Research Board (HRB) also compiled an evidence review of workplace tools and resources[2] and the National University of Ireland, Galway completed a *Proposal for the Development of an Accreditation Model for Healthy Workplaces*.[3] One of the key issues that emerged from these pieces of research was the need for a change in workplace culture. In particular, workers believed that organisational culture was one of the most important factors that could influence workplace health and well-being.[1]

Specifically, the purpose of this review is to support the development and implementation of the National Healthy Workplace Framework by providing an evidence base for healthy workplace culture. One of the actions in the framework is to develop best practice guidelines to improve workplace health through culture change, and this evidence review will enable this to progress.

The review will inform an oversight group tasked with the implementation of the framework, as well as all workplaces delivering workplace programmes.

1.1 Review questions

The following questions were agreed with the Department of Health:

1. Does a culture of health and well-being in an organisation influence the health and well-being of workers?
2. What factors drive this influence on health and well-being?

Question 1 will assess if an organisation's intent to provide a culture of health and well-being, and the types of interventions or cultural changes they implement, can affect the health and well-being of their workers. Question 2 will address what specific cultural changes drive these effects on the health and well-being of workers.

2 Methodology

2.1 Eligibility criteria

From the literature, we have gleaned that there is no standardised definition for a 'workplace culture of health and well-being'. Available definitions range from quite narrow to very broad, so for the purposes of this review, we will keep the definition broad in order to ensure that our eligibility criteria capture all relevant evidence. We have chosen to use the recent work of Safeer and Allen (2019) – whose paper builds on previous studies with the aim of producing a broad and holistic understanding of the concept of a workplace culture of health and well-being – as a guide. According to Safeer and Allen:

"Culture, as it pertains to health, is often embedded and demonstrated in food choices, relationships, sleep patterns, work–life balance, safety precautions, and tobacco use. Health culture influences us through formal (i.e., workplace policies) and informal (i.e., how we spend our lunch break) mechanisms. Cultural influences sometimes run contrary to a profession's stated goal. Take for example, health care workers who regularly share foods high in sodium, fat, and sugar. Culture can be transmitted through formal training provided by leaders and the informal learning that is passed between peers. Cultures are often comprised of multiple subcultures that include unique subsets (i.e., profession, work location, shift) of influences within a broader culture. With this understanding of culture, it is fitting for our professional community to define a 'Culture of Health' in the workplace to be 'a web of social influences that manifests itself in shared healthy beliefs and behaviors'."[4(p863)]

Safeer and Allen emphasised that "culture shapes beliefs and behavior through a complex web of social influences… While it is difficult to capture all of the nuances and possible social influences in a single set of culture categories, it is helpful to start with an analysis of the most likely social factors. In order to focus attention on a more inclusive definition of culture, [Safeer and Allen] organized cultural influences into six primary and overlapping spheres of influence (Figure 1). Together they provide a conceptual map for cultural analysis and change."[4]

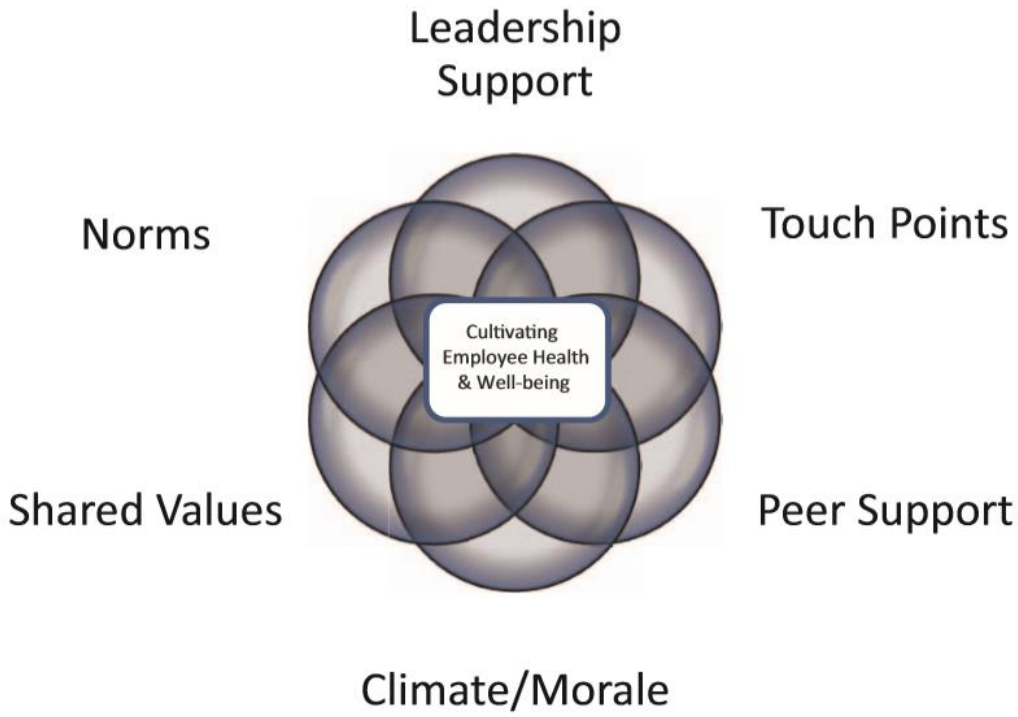

Figure 1 The spheres of cultural influence

Source: Safeer and Allen, 2019

Studies will be considered based on the eligibility criteria outlined in Table 1. Our population of interest consisted of workers, employees, and managers with at least 50 participants. This criterion was based on the OECD's definition of business size[5]. According to the OECD, small and medium-sized enterprises (SMEs) employ fewer than 250 people. SMEs are further subdivided into micro enterprises (fewer than 10 employees), small enterprises (10 to 49 employees), and medium-sized enterprises (50 to 249 employees). Large enterprises employ 250 or more people[5]. We decided to include studies of medium to large enterprises (>50 employees) as we believed this would be more relevant to support the development and implementation of the National Healthy Workplace Framework in Ireland.

With the aim of identifying the most relevant and up-to-date literature, studies published from 2005 to present will be included. The Bangkok Charter for Health Promotion in a Globalized World was signed after the World Health Organization's 6th Global Conference on Health Promotion in 2005.[6] While noteworthy for several reasons, a significant reason was a key commitment to make health promotion a requirement for good corporate practice. For the first time, The Bangkok Charter for Health Promotion in a Globalized World explicitly recognised that employers/corporations should practise health promotion in the workplace. Limiting our eligibility criteria to all studies published from 2005 to present is likely to increase the relevance of the literature to answering our questions regarding a workplace culture of health and well-being.

Originally, we chose to include qualitative, quantitative, and mixed-methods studies in all languages, as per our search strategy in Section 2.2.1. However, due to the large number of results, our eligibility criteria needed to be refined.

Most qualitative research studies identified from our search did not use a recognised method of qualitative analysis (as per Creswell and Poth, 2016[7] – case study research, ethnography, grounded theory

research, narrative analysis, and phenomenology) rendering it inappropriate to synthesise such research. We decided that only studies using quantitative methods with a counterfactual would be included. We included controlled experimental study designs only, as they can rigorously test the hypotheses of interest and establish clear causal links. Counterfactuals needed to demonstrate what would happen in the absence of an intervention; studies that compared two versions of an intervention with no baseline measure or 'usual practice' condition were not included.

Further, due to the complexity of the language surrounding culture, it was decided to only include studies published in the English language.

Table 1 Eligibility criteria for Questions 1 and 2

Domain	Inclusion criteria	Exclusion criteria
Population	Workers, employees, managers (at least 50 participants)	Any other population (<50 participants) Clinical subgroups
Exposure	Culture of health and well-being influenced or introduced by the organisation	No description or discussion of a culture of health or well-being, organisational culture, or synonyms as described in Table 3 Discussion of a culture of health and safety, with focus on safety measures in the workplace
Outcomes	Study must investigate an association or link between a workplace culture and health and well-being outcomes (Table 2)	Studies that do not investigate a link between workplace culture and health and well-being outcomes
Setting	Study conducted at a worksite or workplace at an organisational level	Studies that were not conducted at a worksite Studies that were conducted at a national or state level Studies that included multiple organisations
Research type	Published, peer-reviewed research studies Studies using quantitative methods with experimental design e.g. randomised controlled trials, cohort studies and pre-post studies Studies that include a counterfactual	Unpublished, non-peer-reviewed research studies Studies using qualitative research methods Studies that do not include a counterfactual Opinion pieces, testing/validation of models or instruments, study protocols, letters to the editor, conceptual/theoretical papers, conference proceedings, theses, systematic reviews
Location	Organisation for Economic Co-operation and Development (OECD) member countries	Non-OECD countries
Date	2005–present	Pre-2005
Language	English language	Non-English-language studies

As this review seeks to act as a companion piece to work carried out by the Research Services Unit in the Department of Health, the same health behaviours and health outcomes as those examined in *An Umbrella Review of the Effectiveness and Cost-Effectiveness of Workplace Wellbeing Programmes*, by Murphy *et al.*, 2018, were chosen.[8] These are listed in Table 2.

Table 2 Health and well-being outcomes

Health behaviours	Health outcomes
Physical activity and fitness	Weight and body mass index (BMI)
Smoking	Body fat percentage

Health behaviours	Health outcomes
Fruits and vegetables	Physiological (e.g. blood pressure, cholesterol)
Dietary	Physical well-being
	Mental well-being
	Stress/distress
	Anxiety and depression
	Mental health
	Well-being*
	Self-perceived health

Source: Murphy *et al*., 2018

*As a consequence of the disparate theoretical views and definitions of both well-being[9-11] and workplace well-being,[12-16] for the purposes of this review, the terms used are very specific. As per Jarden *et al*.'s systematic review protocol for the quality appraisal of workers' well-being measures, we decided that for a measure to be included, the term 'well-being' must be specifically stated as either 'wellbeing', 'well-being', or 'well being'.[17]

Table 3 Accepted synonyms

Culture of health and well-being
Organisational culture
Workplace culture
Culture of health
Organisational climate
Organisational ethos
Psychosocial work environment

2.2 Identifying research evidence

2.2.1 Search strategy

This evidence review included two distinct research questions:

1. Does a culture of health and well-being in an organisation influence the health and well-being of workers?
2. What factors drive this influence on health and well-being?

From an early stage in the review process and following preliminary scoping searches, the research team decided to undertake one comprehensive search of the published, peer-reviewed research on the organisational culture of health in order to answer both questions. The search strategy emerged from a PICO (population, interventions, comparators, and outcomes) framing of the research questions, and was based on three overarching concepts: an organisational culture of health (I); the health and well-being of workers (P and O); and qualitative, quantitative, and mixed-methods research. Figure 2 illustrates the three overarching search concepts. Because there is no standard definition for an 'organisational culture of health and well-being', we chose to use the recent work of Safeer and Allen (2019) – whose paper builds on previous research with the aim of producing a broad and holistic understanding of the concept of a workplace culture of health and well-being – as a guide to informing that aspect of the search strategy. Medical Subject Headings (MeSH) terms and appropriate keywords were compiled based on Safeer and Allen's broad definition. MeSH terms and keyword terms were developed for the concept of health and well-being of workers. In addition to the two primary concepts, an adapted search filter was applied in order to capture the concept of qualitative, quantitative, and mixed-methods research.[18]

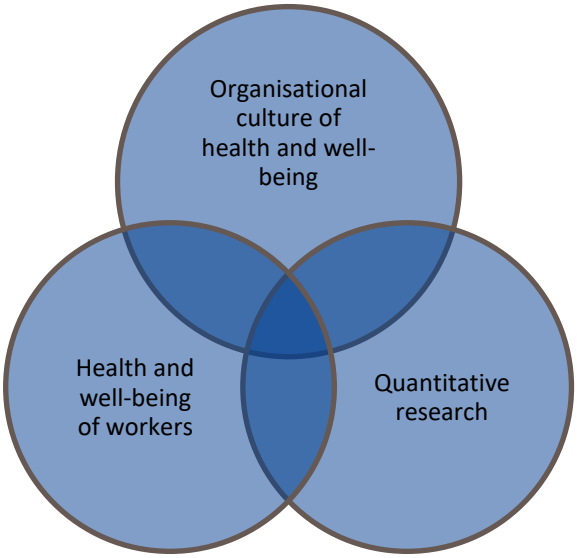

Figure 2 Three-concept search strategy

The search strategy was initially developed for the MEDLINE (Ovid) database and consisted of a combination of controlled vocabulary terms (specific to each database) and natural language keywords, combined using appropriate Boolean operators.

The search strategy was developed by two information specialists (LF and AF) in consultation with the research team. It was peer reviewed and modified following consultation with another information specialist in the HRB (CL). All searches were undertaken between 1 and 14 September 2020. A complete PRISMA-S (Preferred Reporting Items for Systematic reviews and Meta-Analyses literature search extension) checklist[19] for reporting literature searches in systematic reviews is available in Appendix A.

2.2.2 Limits

No language limits were applied to the search strategy; however, a date limit was applied. The research team chose to exclude research published before 2005, as per the justification in Section 2.1 on the review's eligibility criteria.

2.2.3 Databases

Preliminary exploratory searches indicated that articles informing the research questions were situated in a range of sources, including medical, sociological, and psychological sources. The search strategy was initially developed for the MEDLINE (Ovid) database and was subsequently translated for use in the CINAHL, SocINDEX (both on the EBSCO platform), and PsycINFO (Ovid) databases. These databases cover a range of subject areas and professions and emphasise different geographical areas, ultimately providing a wide scope of research sources. The database search parameters are available in Appendix B and the full search strategies and search filters used in the four databases are available in Appendix C.

2.2.4 Journals

At an early stage of the review, the *American Journal of Health Promotion* and the *Journal of Occupational and Environmental Medicine* were deemed particularly relevant in the field of workplace culture. These journals were hand-searched for potential articles.

2.2.5 Supplementary search strategies

It is well recognised that qualitative research can be difficult to retrieve using conventional systematic review search methods; this is due to inadequate descriptions of methods in published abstracts.[20,21] Consequently, it was considered important to supplement the main database searches using the following supplementary search strategies:

Reference checking: The reference section of each included article was screened for relevant references. References were screened by title and abstract by two members of the research team (JQ and KL).

Citation chasing: Articles that cited the included articles were screened for additional relevant references. This was done for each article using the "cited by" function in Google Scholar. References were screened by title and abstract by two members of the research team (JQ and KL).

Reference chasing of relevant systematic reviews: Twenty-nine systematic reviews were identified in the search. The systematic reviews were screened by title and abstract for relevance by one member of the research team (LF).

2.3 Screening

All database and supplementary search results were imported into EndNote X9 in order to deduplicate using the Bramer[22] method, and were then imported into a bespoke spreadsheet in Microsoft Excel for title and abstract screening. A Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow diagram detailing the exact search results of the multiple searches for the review is provided in Figure 3.

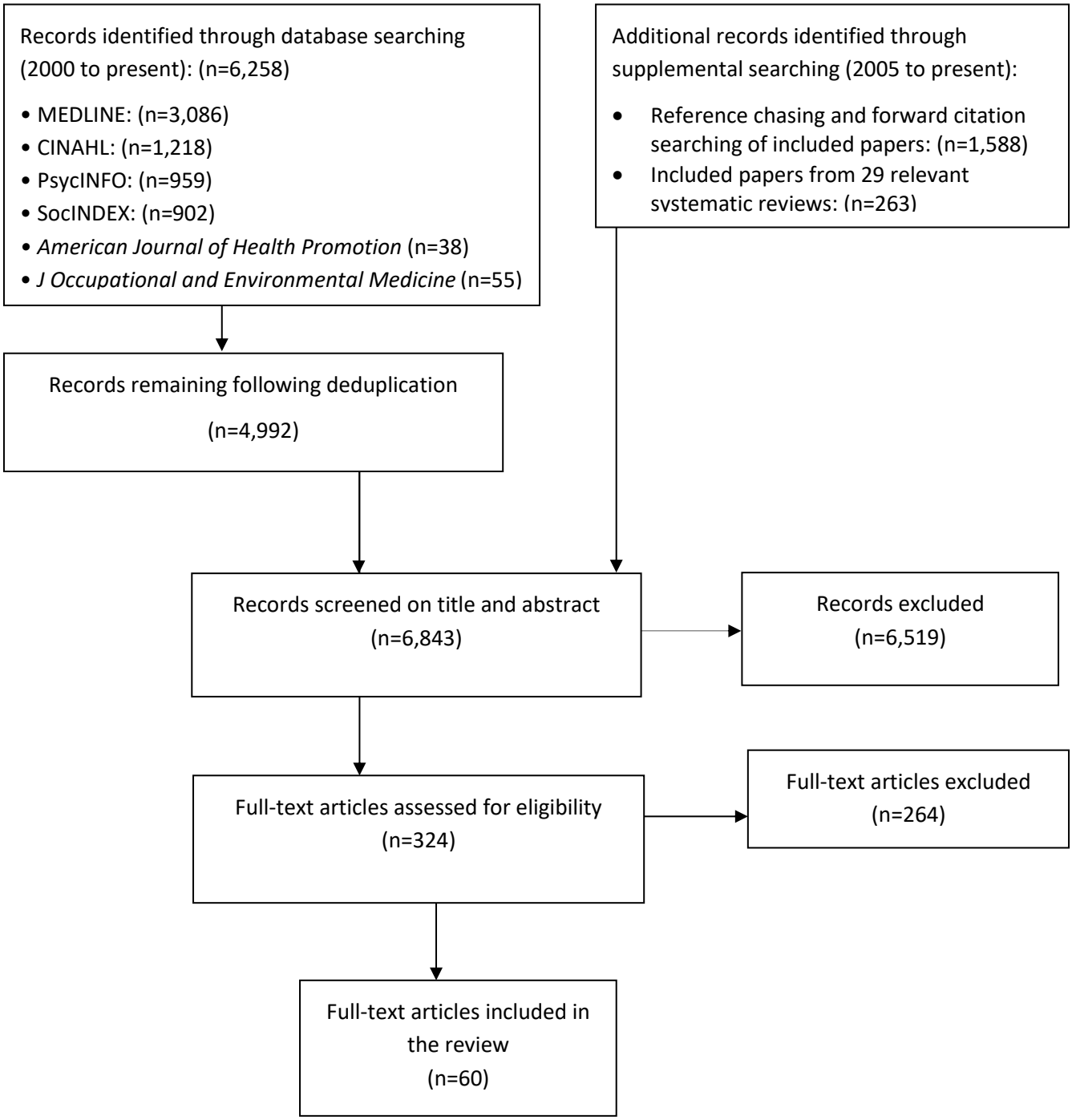

Figure 3 PRISMA flow diagram

For the database search, references were screened by title and abstract by two members of the review team. Conflicts were resolved through consensus. Full-text articles were retrieved and subsequently screened by two members of the review team. Again, conflicts were resolved through consensus.

2.4 Data extraction

Data were extracted verbatim into a bespoke extraction sheet by one reviewer and verified by a second reviewer.

We extracted data on the following:

- Study design: number of participants at baseline, description of participants, study time frame, length of exposure, design, intervention, counterfactual
- Baseline characteristics of participants at baseline: mean age, percentage employed full time, percentage female, average tenure in years
- Statistical investigation of relationship between cultural and health/well-being outcomes
- Cultural measures: sphere of culture, measure/scale, description of measure/scale, direction of effect, and
- Health/well-being measures: measure/scale, description of measure/scale, direction of effect.

The direction of effect for each cultural and health and well-being outcome was coded with symbols, as follows:

- + = beneficial effect of intervention
- - = detrimental effect of intervention
- o = no effect of intervention, and
- ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up).

2.5 Quality assessment

We used the Effective Public Healthcare Panacea Project's Quality Assessment Tool for Quantitative Studies to critically appraise the included studies, with each study assessed by two independent reviewers.[23] Any disagreements that arose between the reviewers were resolved through discussion or with a third reviewer.

Certainty about the evidence was assessed using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach.[24] The GRADE approach specifies four levels of the certainty for a body of evidence for a given outcome: high, moderate, low and very low. These assessments of certainty are determined through consideration of five domains: risk of bias, inconsistency, indirectness, imprecision and publication bias. [24]

2.6 Data synthesis

A feasibility analysis was conducted to determine the type of analysis most suitable for this review. With the diverse range of included studies, and the heterogeneity of interventions and outcomes, it was decided that a quantitative synthesis (e.g. meta-analysis) was not feasible. Thus, we used a narrative synthesis to bring together the results of the review.

Data synthesis was carried out in two stages in order to answer both research questions.

Firstly, data were thematically summarised according to the intervention investigated. Eight intervention groups (themes) were iteratively determined by the HRB, based on the setting and primary aim of the intervention. Where a study could have been allocated to more than one theme, the study was put forward for further examination by the research team. The final decision was based on the objectives the intervention was implemented to achieve, with reference to the outcome of interest. The intervention groups are listed in Figure 4. Section 3.3 thematically summarises the influence of interventions on the health and well-being of workers and culture outcomes.

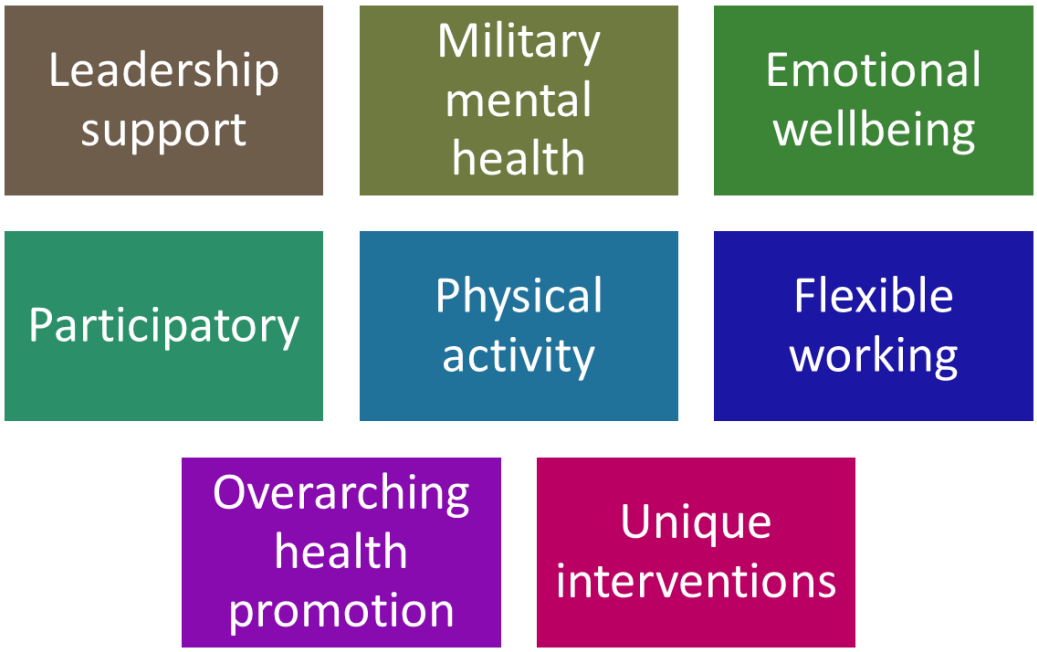

Figure 4 Intervention groups for data synthesis

Secondly, in order to determine what cultural factors drive this influence on health and well-being, we analysed the data considering cultural measures as a mediator between the intervention and health and well-being outcomes (Figure 5). We only considered studies that tested a statistical model of this pathway in this analysis.

Figure 5 Mediation pathway

In order to be considered key cultural drivers, culture outcomes needed to meet two criteria: (1) show mediation relationships with health and well-being outcomes in three instances, and (2) show mediation relationships with health and well-being outcomes in at least two separate studies. The results of this analysis are reported in Section 3.4.

3 Findings

3.1 Results of the search

Sixty studies, reported across 60 articles, met the inclusion criteria. One study was reported across two articles[25,26] and one article reported findings from two separate studies, both of which met the inclusion criteria.[27]

The study locations are listed in Table 4.

Table 4 Study locations

Location	Number of studies
Australia	4
Belgium	2
Canada	5
Denmark	5
Finland	5
Germany	3
Japan	3
Korea	1
Netherlands	3
Norway	1
Sweden	6
United Kingdom	2
United States of America	19
United States of America and Canada	1

3.2 Quality assessment

We used the Effective Public Healthcare Panacea Project's Quality Assessment Tool for Quantitative Studies to critically appraise the included studies.[23]

A summary of the critical appraisal of included studies is reported in Table 5.

Only one of the studies had a strong rating. Ten were considered moderate and 49 were considered of weak quality. The studies were appraised as being particularly weak in blinding, with 55/60 considered weak on this criterion. The full explanation of the decision is given in Appendix G.

Table 5 Summary critical appraisal

Study ID	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and dropouts	Global rating
Adler 2009	Moderate	Strong	Strong	Weak	Strong	Weak	Weak

Study ID	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and dropouts	Global rating
Anderzén 2005	Moderate	Strong	Weak	Weak	Strong	Moderate	Weak
Arundell 2018	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Aust 2010	Moderate	Moderate	Strong	Weak	Strong	Moderate	Moderate
Barrech 2017	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Bourbonnais 2011	Moderate	Moderate	Strong	Weak	Strong	Weak	Weak
Brakenridge 2016	Weak	Strong	Strong	Weak	Strong	Moderate	Weak
Castro 2012	Strong	Strong	Moderate	Weak	Strong	Weak	Weak
Crain 2019	Weak	Strong	Weak	Weak	Strong	Moderate	Weak
Delanoeije 2020	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Dishman 2009	Weak	Strong	Weak	Weak	Strong	Weak	Weak
Elo 2008	Weak	Moderate	Not applicable	Moderate	Strong	Weak	Weak
Elo 2014	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Fikretoglu 2019	Strong	Strong	Strong	Strong	Strong	Moderate	Strong
Gilbert-Ouimet 2011	Strong	Weak	Strong	Weak	Strong	Not applicable	Weak
Gregory 2018	Moderate	Weak	Strong	Weak	Strong	Not applicable	Weak
Hamar 2015	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Hammer 2011	Weak	Strong	Strong	Weak	Strong	Moderate	Weak
Havermans 2018	Moderate	Strong	Strong	Weak	Strong	Moderate	Moderate
Hendriksen 2016	Strong	Moderate	Not applicable	Weak	Weak	Weak	Weak
Holman 2016	Strong	Moderate	Strong	Weak	Strong	Weak	Weak
Hosboyar 2018	Weak	Weak	Weak	Weak	Strong	Weak	Weak
Jarman 2015	Weak	Moderate	Strong	Weak	Strong	Not applicable	Weak
Jeon 2015	Weak	Strong	Strong	Strong	Strong	Weak	Weak
Kawakami 2005	Strong	Strong	Weak	Weak	Strong	Strong	Weak
Kim 2014	Strong	Moderate	Not applicable	Weak	Strong	Strong	Moderate
Kobayashi 2008	Strong	Strong	Strong	Weak	Strong	Strong	Moderate
Kukkurainen 2012	Weak	Weak	Weak	Weak	Weak	Not applicable	Weak
Lavoie-Tremblay 2005	Strong	Moderate	Not applicable	Weak	Strong	Strong	Moderate
Li 2017	Moderate	Weak	Strong	Weak	Strong	Weak	Weak

Study ID	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and dropouts	Global rating
Lundmark 2017	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Mache 2020	Strong	Moderate	Not applicable	Weak	Strong	Weak	Weak
Mattila 2006	Strong	Moderate	Strong	Weak	Strong	Strong	Moderate
Michishita 2017	Weak	Strong	Strong	Weak	Strong	Strong	Weak
Moen 2011	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Moen 2013a	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Moen 2013b	Strong	Moderate	Strong	Weak	Strong	Weak	Weak
Moen 2016	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate
Mulligan 2012	Moderate	Strong	Weak	Weak	Strong	Weak	Weak
Neves 2018	Moderate	Moderate	Weak	Weak	Strong	Not applicable	Weak
Nielsen 2009	Moderate	Weak	Weak	Weak	Strong	Not applicable	Weak
Nielsen 2012	Strong	Moderate	Strong	Weak	Strong	Weak	Weak
Odle-Dusseau 2016	Weak	Weak	Weak	Weak	Strong	Not applicable	Weak
Olson 2015	Moderate	Strong	Weak	Moderate	Strong	Weak	Weak
Pryce 2006	Weak	Moderate	Weak	Weak	Strong	Weak	Weak
Seidel 2017	Weak	Moderate	Not applicable	Weak	Weak	Not applicable	Weak
Sjögren 2006	Moderate	Strong	Weak	Moderate	Strong	Strong	Weak
Steele Gray 2015	Moderate	Moderate	Strong	Weak	Strong	Weak	Weak
Tafvelin 2019a	Moderate	Moderate	Strong	Weak	Weak	Weak	Weak
Tafvelin 2019b	Moderate	Moderate	Not applicable	Weak	Moderate	Moderate	Moderate
Vaag 2013	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Van Bogaert 2014	Moderate	Weak	Weak	Weak	Strong	Not applicable	Weak
van Scheppingen 2014	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
von Thiele Schwarz 2015	Strong	Strong	Strong	Weak	Strong	Weak	Weak
von Thiele Schwarz 2017 – Case 1	Weak	Strong	Weak	Weak	Strong	Strong	Weak
von Thiele Schwarz 2017 – Case 2	Moderate	Strong	Strong	Weak	Strong	Moderate	Moderate
Wieneke 2016	Weak	Moderate	Weak	Weak	Strong	Not applicable	Weak

Study ID	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and dropouts	Global rating
Wieneke 2019	Moderate	Weak	Weak	Weak	Strong	Not applicable	Weak
Williams 2007	Strong	Strong	Strong	Weak	Strong	Weak	Weak
Wyman 2020	Strong	Strong	Strong	Weak	Strong	Strong	Moderate

3.3 Intervention effects

Question 1: Does a culture of health and well-being in an organisation influence the health and well-being of workers?

To address Question 1, we extracted data on the impact of interventions on health and well-being outcomes and culture outcomes. Interventions were grouped into eight categories according to their function (e.g. interventions targeting leadership support, emotional well-being, flexible working, etc.).

A note on terminology: a number of studies examined intervention effects on conflict between work and home life, described as "work–to–home conflict", "work–home conflict", "or work–family conflict". When discussing the findings for this outcome in aggregate across all studies, we use the phrase "work–family conflict" as a standard term. However, when presenting the findings of individual studies in the tables below, we present these outcomes using the specific terminology used by the authors of the individual studies.

3.3.1 Overarching health promotion interventions

Five studies evaluated interventions that introduced overarching health promotion programmes in workplaces.[28-32]

3.3.1.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 6. Two studies were carried out in the Netherlands, one in Australia, one in Sweden, and one in the United States of America (USA).

Table 6 Inclusion criteria in overarching health promotion intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Hamar 2015[28]	USA	1,136 employees, 1,540 controls	Employees of a midsize employer in the insurance and financial sector headquartered in Los Angeles, California, compared with a random sample of employed individuals aged between 18 and 67 years residing in the Los Angeles metropolitan statistical area and collected during the same months as employer survey administration
Hendriksen 2016[29]	Netherlands	433	Employees and managers of a division of a Dutch insurance company, mainly white-collar workers

Study ID	Location	No. of participants enrolled	Description of participants
Jarman 2015[30]	Australia	3,406	Tasmanian Government public sector workers
van Scheppingen 2014[31]	Netherlands	629	Employees of a Dutch dairy company
von Thiele Schwarz 2015[32]	Sweden	356	Employees of a county hospital in Sweden

The interventions, length of study, and counterfactuals are reported in Table 7. The five overarching health promotion interventions were multicomponent programmes with the aim of improving employee health by offering resources, guidance, and activities, or with the aim of integrating well-being initiatives like these into existing organisational structures. All study designs had pre- and post-intervention measures and were a mix of observational, quasi-experimental, and experimental designs.

Table 7 Study designs in overarching health promotion intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Hamar 2015	2 years	2 years	Observational pre-post study	Healthways well-being improvement programme	Individualised feedback and personalised well-being plan provided to employees based on annual well-being assessment and biometric screening, alongside fostering leadership support for programme participation and individual action, support for culture of well-being through competitions, access to classes, messaging supporting healthy lifestyles, education events, and other activities.	Baseline measures, general population controls
Hendriksen 2016	5 months	5 months	Pre-post study	Health promotion programme	Activities at management, team, and individual level targeting self-management to	Baseline measures

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					perform healthy behaviours: a kick-off session, vitality training sessions, workshops, individual coaching, and intervision.	
Jarman 2015	3 years	3 years	Pre-post study	Healthy@Work	Healthy@Work workplace health promotion, strategy, and action plans developed at department level; strategies targeted mental health and well-being, health education, assessments, physical activity, injury management, and organisational change (e.g. increasing physical space for healthy activities, availability of healthy food, on-site gyms, access to stairs, health information bulletins).	Baseline measures
van Scheppingen 2014	18 months	18 months	Quasi-experimental pre-post study	Large-scale intervention	Promotion of dialogue and reflective thinking on the value of health and vitality at work; collective vitality-promoting activities at department level (e.g. lunchtime walking, active commuting, training for posture and work style, provision of healthy snacks); and physical activities at	Control group (participated in/received none of the components)

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					organisational level (e.g. running/cycling races, team sports).	
von Thiele Schwarz 2015	24 months	Unclear	Cluster randomised controlled trial	Kaizen for health promotion and protection	Integration of health promotion and protection systems to be built on existing kaizen work without addition of new structures. Workshops for kaizen and health representatives, managers from participating units, coaching of unit managers, local management were responsible for integration. Local management was responsible for integration with support of a coach.	Baseline measures, matched control units

3.3.1.2 Baseline characteristics

The characteristics of participants at baseline are reported in Table 8.

Table 8 Baseline characteristics in overarching health promotion intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Hamar 2015	USA	Employees	38.8	-	68.6	-
	USA	General population (control)	-	-	-	-
Hendriksen 2016	Netherlands	All participants	42.2	62.1	52.9	-
Jarman 2015	Australia	Baseline men	47.1	84	-	14.1
	Australia	Baseline women	45.8	51	-	12.7
van Scheppingen 2014	Netherlands	All participants	-	-	20	-
	Netherlands	Control	-	-	23.2	-

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
	Netherlands	Intervention	-	-	21.9	-
von Thiele Schwarz 2015	Sweden	Intervention	46.7	49.1	96.4	9.9 (in current departme nt)
	Sweden	Control	45	50.6	91.2	7.2 (in current departme nt)

3.3.1.3 Outcomes

3.3.1.3.1 Health and well-being

The health and well-being outcomes for the overarching health promotion intervention studies are reported in Table 9.

All but one study[32] reported intervention effects on at least some health and well-being outcomes, including health behaviours, physical and mental health outcomes, and general well-being outcomes.

Table 9 Health/well-being outcomes in overarching health promotion intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Hamar 2015	Healthways well-being improvemen t programme	Healthy behaviour (diet and physical activity)	Well-Being Assessment, scored using the Individual Well-Being Score (IWBS)	Increased at 2-year follow-up	+
		Physical activity level	Well-Being Assessment, scored using the IWBS	Examined as a composite measure	~
		Tobacco use	Blood test for presence of nicotine	Examined as a composite measure	~
		BMI	Well-Being Assessment, scored using the IWBS	Examined as a composite measure	~
		Chronic and acute conditions	Well-Being Assessment, scored using the IWBS	Examined as a composite measure	~
		Impact of conditions on functioning	Well-Being Assessment, scored using the IWBS	Examined as a composite measure	~
		Pain	Well-Being Assessment, scored using the IWBS	Examined as a composite measure	~
		Systolic blood pressure	Biometric health screen (mm Hg)	Examined as a composite measure	~
		Diastolic blood pressure	Biometric health screen (mm Hg)	Examined as a composite measure	~

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Total cholesterol	Biometric health screen (mg/dL)	Examined as a composite measure	~
		High-density lipoprotein cholesterol	Biometric health screen (mg/dL)	Examined as a composite measure	~
		Self-rated health status	Not specified	Examined as a composite measure	~
		Emotional health	Well-Being Assessment, scored using the IWBS	Increased at 2-year follow-up	+
		Life evaluation	Well-Being Assessment, scored using the IWBS	Increased at 2-year follow-up	+
		Illness days in last year	Illness days in last year	Examined as a composite measure	~
		Use of medication for relaxation	Well-Being Assessment, scored using the IWBS	Examined as a composite measure	~
		Physical health	Composite measure (Well-Being Assessment, scored using the IWBS)	Increased at 2-year follow-up	+
Hendriksen 2016	Health promotion programme	Fruit consumption	1 item from the Energy & Performance Scan	Increased at 5- and 15-month follow-up	+
		Vegetable consumption	1 item from the Energy & Performance Scan	Increased at 5- and 15-month follow-up	+
		Moderate to vigorous physical activity	1 item from the Energy & Performance Scan	Increased at 5-month follow-up	+
		Sedentary behaviour	1 item from the Energy & Performance Scan	Reduced at 5- and 15-month follow-up	+
		Relaxation	3 items from the Energy & Performance Scan	Increased at 5-month follow-up	+
		Tobacco use	1 item from the Energy & Performance Scan	No change	o
		Alcohol consumption	1 item from the Energy & Performance Scan	No change	o
		Self-management	4 items from the Energy & Performance Scan	Increased at 5- and 15-month follow-up	+
		Self-rated health	1 item from the Energy & Performance Scan	Increased at 5- and 15-month follow-up	+
		Total cholesterol level	Biometric health screen (mmol/L)	No change	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Systolic blood pressure	Biometric health screen (mm Hg)	Reduced at 5-month follow-up	+
		Fat percentage	Biometric health screen	No change	o
		Emotional exhaustion	1 item from the Energy & Performance Scan	No change	o
		Work–life balance	1 item from the Energy & Performance Scan	No change	o
		Vitality	6 items from the Energy & Performance Scan	Increased at 15-month follow-up	+
		Self-rated vitality	1 item from the Energy & Performance Scan	Increased at 5- and 15-month follow-up	+
		Sickness absence	Cumulative sickness absence days over 12 months	No change	o
Jarman 2015	Healthy@Work	Self-esteem	Reward subscale of the Effort–Reward Imbalance (ERI) questionnaire	Increased over time (for women only) in association with intervention availability	+
van Scheppingen 2014	Large-scale intervention	Physical activity	2-item bespoke measure	Increased under intervention	+
		Tobacco use	Bespoke single item	Decreased under intervention	+
		Alcohol use	Bespoke single item	No change	o
		Healthy dietary habits	2 items from Short Food Frequency Questionnaire	Increased under intervention	+
		Perceived health	Bespoke single item	Increased under intervention	+
		Emotional exhaustion	Subscale of the Utrecht Burnout Scale	No change	o
		Relaxation	2-item bespoke measure	No change	o
		Vitality at work	Subscale of the Utrecht Work Engagement Scale	No change	o
		Sustainable employability	Bespoke single item	Increased under intervention	+
von Thiele Schwarz 2015	Kaizen for health promotion and protection	Self-rated health	Bespoke single item	No change under intervention	o
		Sickness absenteeism	2-item bespoke scale	No change under intervention	o

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.1.3.2 Culture

The culture outcomes for the overarching health promotion intervention studies are reported in Table 10. The multicomponent interventions described by Hendriksen *et al.*[29] and van Scheppingen *et al.*[31] led to improvements in a number of cultural measures, including organisational and supervisor support and measures of social climate. Jarman *et al.*[30] reported a deterioration in cultural measures for men under a similar intervention, such that perceived effort increased, leading to a less favourable effort–reward balance. A kaizen intervention programme successfully improved health promotion and integration of health and well-being initiatives in one study.[32]

Table 10 Culture outcomes in overarching health promotion intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Hamar 2015	Healthways well-being improvement programme	Employer support	1 item from Well-Being Assessment, scored using the IWBS	Change over time not analysed, only relationship to other variables	N/A
		Organisational support index measure	4 items from Well-Being Assessment, scored using the IWBS	Change over time not analysed, only relationship to other variables	N/A
Hendriksen 2016	Health promotion programme	Supervisor-rated organisational support	5 items from the Management Vitality Perception Scan	Increased at 5- and 15-month follow-up	+
		Supervisor-rated "Role of the supervisor" scale	5 items from the Management Vitality Perception Scan	Increased at 15-month follow-up	+
Jarman 2015	Healthy@Work	Effort	6-item subscale of the ERI questionnaire	Increased for men over time in association with intervention; no change for women over time	-
		Reward	11-item subscale of the ERI questionnaire	No change for men or women	o
		Effort–reward imbalance	ERI questionnaire (weighted ratio of effort to reward)	Increased for men over time in association with intervention; no change for women over time	-
van Scheppingen 2014	Large-scale intervention	Bonding social capital	3-item bonding social capital subscale of	Increased under intervention	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
			the Social Capital Scale		
		Openness towards health and vitality at work	2-item bespoke scale	Increased under intervention	+
von Thiele Schwarz 2015	Kaizen for health promotion and protection	Workplace-based health promotion	5-item bespoke scale	Improved under intervention over time	+
		Integration	4-item bespoke scale	Improved under intervention over time	+
		Kaizen	3-item bespoke scale	Improved under intervention over time	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up), N/A= not applicable

3.3.1.3.3 Association between culture and health and well-being

Two studies[28,29] formally assessed the link between workplace culture measures and health/well-being outcomes (Table 11) using linear regression models. Both studies confirmed an association between at least some cultural measures – including supervisor/organisational support – and health/well-being outcomes. Of the three studies that did not formally assess the link between culture measures and health/well-being outcomes, two reported discordant findings, in which cultural measures improved or declined without corresponding expected effects on health/well-being measures.[30,32]

Table 11 Association between culture and health/well-being outcomes in overarching health promotion intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Hamar 2015	Healthways well-being improvement programme	Yes	Linear regression models	Yes	Increases in employer support for well-being and positive attitudes on the role of the supervisor were associated with improved well-being.

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Hendriksen 2016	Health promotion programme	Yes	Generalised linear model used. Log link used for sickness absence, smoking, alcohol consumption, emotional exhaustion, attitude, and work–life balance; time variable used to examine change across time points; covariate effects estimated at second level of model.	Yes	Good organisational support and involved supervisors were associated with lower sickness absence.
Jarman 2015	Healthy@Work	No	-	-	No apparent correspondence between culture and health/well-being measures. Increased perceived effort for men only not associated with changes in self-esteem; no change in perceived effort/reward for women, but an increase in self-esteem was observed.
van Schepping en 2014	Large-scale intervention	No	-	-	Bonding social capital, openness to health and vitality at work, smoking, healthy eating, and sustainable employability all improved under intervention.
von Thiele Schwarz 2015	Kaizen for health promotion and protection	No	-	-	No apparent correspondence between culture and health/well-being measures. Significant improvements in cultural

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
					metrics but not in health outcomes.

3.3.1.4 Certainty of evidence

We believe there is moderate-certainty evidence to support the findings for overarching health promotion interventions. This is based on weak study designs but consistent findings.

3.3.2 Physical activity interventions

Five studies examined interventions to encourage physical activity.[33-37]

3.3.2.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 12. Two studies were based in Australia, one study was based in the USA and Canada, one study was based in Japan, and one study was based in Finland.

Table 12 Inclusion criteria in physical activity intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Dishman 2009[33]	USA, Canada	1,442	Employees of Home Depot without overt cardiovascular, pulmonary, or metabolic disease
Michishita 2017[34]	Japan	63	White-collar workers
Sjögren 2006[35]	Finland	90	Workers in various departments of the City of Kuopio central administration
Arundell 2018[36]	Australia	146 consented (82 intervention, 64 comparison)	Intervention and control participants from separate municipal workplaces in the same local government area in Victoria, Australia. Eligibility criteria included being aged over 18 years, employed primarily in an office-based job (i.e. outreach workers were ineligible), on a full- or part-time contract, and anticipation of employment at the workplace until at least March 2015.
Brakenridge 2016[37]	Australia	153	Employees of an international property and infrastructure group at two locations in Sydney and Brisbane, which received different versions of the intervention. Teams had to work at relevant locations (A or B) or work near to and regularly visit the head office (location A), working a minimum of 50% of full-time equivalent hours.

Table 13 Study designs in physical activity intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention	Intervention full description	Counterfactual
Dishman 2009	5 months	3 months	Randomised controlled trial (RCT)	Move to improve	Personal goals combined with an ecologically derived organisational action component. The goal-setting component of the intervention focused on personal goals and team goals that were self-set, specific regarding performance and time, realistic but attainable, and easily assessed. The organisational action component had four features: senior management endorsement, joint employee–management steering committees, group and organisational goals and incentives, and environmental prompts.	Usual treatment
Michishita 2017	10 weeks	10 weeks	RCT	Active rest programme	Participants performed the 10-minute lunch fitness programme 3 times per week for 10 weeks (a total of 29 times). The programme takes 10 minutes and was performed during a lunch break. This short-duration exercise	No intervention

Study ID	Study time frame	Length of exposure	Study design	Intervention	Intervention full description	Counterfactual
					programme consisted of warm-up (stretching), cognitive functional training, aerobic exercise, body weight resistance training, and cool-down components.	
Sjögren 2006	30 weeks	15 weeks	Cluster RCT with crossover	Resistance training	The physical exercise intervention consisted of progressive light resistance training and guidance. The participants were entitled to take time out during the working day to train by themselves in the departments' own training facilities when they felt the need to counterbalance their sedentary work or to obtain relief from monotonous and fixed working positions.	No intervention
Arundell 2018	9 months	9 months	Cohort two-group analytic study (pre-post) (longitudinal)	Activity-Based Working (ABW) workplace design	New mobile technologies and etiquette, progressive policy changes (paper reduction, restrictions on eating at desks, encouragement to use different desks), new ABW building with open-plan design, centralised facilities, new technologies, non-delegated	Baseline, 6-month follow-up after move to ABW building, 9-month follow-up after move to ABW building

Study ID	Study time frame	Length of exposure	Study design	Intervention	Intervention full description	Counterfactual
					seating, paperless policy, ban on eating at desks and encouraging utilisation of shared kitchens, workspaces designed for eight types of work.	
Brakenridge 2016	12 months	3 months	Cluster RCT	Organisational support plus/minus tracker	Organisational support based on "Stand Up Australia" implemented by a workplace champion: information booklet on sitting and health implications, recommendations and tips, five fortnightly emails promoting activity, and communication of senior executive support and participation. Tracker group also received activity tracker worn as a belt with smartphone synchronisation, providing feedback on sitting, standing, stepping, sitting breaks, posture, and sleep.	Baseline measures

3.3.2.2 Baseline characteristics

The characteristics of participants at baseline are reported in Table 14.

Table 14 Baseline characteristics in physical activity intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Dishman 2009	USA, Canada	All participants	36.2	-	69	-
Michishita 2017	Japan	All participants	40.9	-	32.2	-
Sjögren 2006	Finland	All participants	45.7	-	73.3	-
Arundell 2018	Australia	ABW workplace	39.1	84.8	64.1	-
	Australia	Comparison workplace	41.4	72.1	83.6	-
Brakenridge 2016	Australia	All participants	38.9	94	46	-
	Australia	Organisational support	40	95	53	-
	Australia	Organisational support plus tracker	37.6	92	40	-

3.3.2.3 Outcomes

3.3.2.3.1 Health and well-being

Health and well-being outcomes are reported in Table 15. Four studies demonstrated effects on a range of health and well-being outcomes, including improvements in health behaviour (e.g. daily steps, activity level, and perceived changes in sitting) and well-being outcomes (e.g. vigour and workplace satisfaction).

Table 15 Health/well-being outcomes in physical activity intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Dishman 2009[33]	Move to improve	Moderate to vigorous activity	International Physical Activity Questionnaire (IPAQ) – Short Form	Greater increase in moderate and vigorous physical activity in the intervention group versus the control group	+
		Daily steps	Steps were assessed using the Yamax SW-200	Greater increase in walking in the intervention group versus the control group	+
		Meeting the recommended level of regular physical activity	USA Healthy People 2010 recommendations	Greater odds of meeting guideline were found in the intervention group versus the control group	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Michishita 2017[34]	Active rest programme	BMI (kg/m^2)	-	No significant benefit in intervention arm	o
		Body fat mass (kg)	-	No significant benefit in intervention arm	o
		Lean body mass (kg)	-	No significant benefit in intervention arm	o
		Waist circumference (cm)	-	No significant benefit in intervention arm	o
		Systolic blood pressure (mm Hg)	-	No significant benefit in intervention arm	o
		Diastolic blood pressure (mm Hg)	-	No significant benefit in intervention arm	o
		Total mood disturbance score	65-item Profile of Mood States Second Edition (POMS 2)	Some change in individual items, but overall, no significant benefit in intervention group	o
		Vigour	Brief Job Stress Questionnaire (BJSQ) (57 items total)	Significantly better in intervention group over time	+
		Irritability	BJSQ (57 items total)	No significant benefit in intervention arm	o
		Fatigue	BJSQ (57 items total)	No significant benefit in intervention arm	o
		Anxiety	BJSQ (57 items total)	No significant benefit in intervention arm	o
		Depression	BJSQ (57 items total)	No significant benefit in intervention arm	o
		Physical complaints	BJSQ (57 items total)	No significant benefit in intervention arm	o
		Satisfaction with job/daily life	BJSQ (57 items total)	Significantly better in intervention group over time	+
		Work ability	Work Ability Index (7 dimensions)	No significant benefit in intervention arm	o
Sjögren 2006[35]	Resistance training	Subjective physical well-being	Descriptive visual rating scales 0–100	Positive direction on subjective physical well-being among office workers	+
		Somatic symptoms	Descriptive visual rating scales 0–100	Intervention had no effect	o
		Anxiety	Descriptive visual rating scales 0–100	Intervention had no effect	o
		Self-confidence	Descriptive visual rating scales 0–100	Intervention had no effect	o
		Mood	Descriptive visual rating scales 0–100	Intervention had no effect	o
		Life satisfaction	Descriptive visual rating scales 0–100	Intervention had no effect	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Meaning of life	Descriptive visual rating scales 0–100	Intervention had no effect	o
Arundell 2018[36]	ABW workplace design	Activity level	GT3X ActiGraph accelerometer	Reductions in sedentary time, increases in light/moderate-to-vigorous physical activity	+
		Workplace eating behaviours	Not specified	Improved under intervention, higher frequency of stopping for lunch, significant increase in frequency of eating lunch with colleagues	+
		Perceived changes in sitting	Not specified	Improved; reductions in sitting and increases in standing/moving reported among intervention participants	+
		Use of height-adjustable desks	Not specified	Descriptive statistics only	N/A
		Workplace satisfaction	4 items from the Health and Work Questionnaire	Increased satisfaction with physical environment under intervention, small increases over time on other dimensions	+
Brakenridge 2016[37]	Organisational support plus/minus tracker	Work satisfaction	Health and Work Questionnaire	No change reported	o
		Overall stress score	Health and Work Questionnaire	No change reported	o
		Mental health quality of life	Short Form-12 version 1	No change reported	o
		Physical health quality of life	Short Form-12 version 1	No change reported	o
		Activity tracker	LUMOback, LUMO Bodytech	No change reported	o

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up), N/A= not applicable

3.3.2.3.2 Culture

The impact of physical activity interventions on culture outcomes is reported in Table 16. Four studies demonstrated effects on culture change measures, particularly around organisational and management support.

Table 16 Culture outcomes in physical activity intervention studies

Study	Intervention	Outcome	Measure/scale	Direction of effect	
Dishman 2009	Move to improve	Management support	5-item scale (Heart check)	There was a linear increase in management support (p>0.05) in the intervention group and a decrease in management support (p<0.05) in the control group.	+
		Employee involvement	Custom scale (4 items)	There was a linear increase in employee involvement (p<0.001) in the intervention group and no change in employee involvement in the control group.	+
Michishita 2017	Active rest programme	Quantitative job workload	BJSQ (57 items total)	No significant difference	o
		Qualitative job workload	BJSQ (57 items total)	No significant difference	o
		Physical demands	BJSQ (57 items total)	No significant difference	o
		Interpersonal stress	BJSQ (57 items total)	Significantly better in intervention group over time	+
		Poor workplace environment	BJSQ (57 items total)	No significant difference	o
		Job control	BJSQ (57 items total)	No significant difference	o
		Skill utilisation	BJSQ (57 items total)	No significant difference	o
		Job aptitude	BJSQ (57 items total)	No significant difference	o
		Worthwhileness of working life	BJSQ (57 items total)	No significant difference	o
		Support from superiors	BJSQ (57 items total)	Significantly better in intervention group over time	+
		Support from colleagues	BJSQ (57 items total)	Significantly better in intervention group over time	+
Sjögren 2006	Resistance training	Mental stress at work	Descriptive visual rating scales 0–100	No significant effect	o
		Working atmosphere	Descriptive visual rating scales 0–100	No significant effect	o
Arundell 2018	ABW workplace design	Organisational support for being physically active in the workplace	Not specified	Increased across time points, higher under intervention	+
Brakenridge 2016	Organisational support plus/minus tracker	Job control	Health and Work Questionnaire	Improved under intervention at long-term follow-up	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.2.3.3 Association between culture and health and well-being

None of the studies explored the association between cultural change and health and well-being outcomes statistically (Table 17). Four of the studies, however, did report common trends in culture and health/well-being outcomes.

Table 17 Association between culture and health/well-being outcomes in physical activity intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Dishman 2009	Move to improve	No	-	No	Employee perceptions of management support and employee involvement increased among intervention participants, but not among employees at control sites.
Michishita 2017	Active rest programme	No	-	No	Some improvement in culture and health/well-being over time in intervention group, but not statistically assessed.
Sjögren 2006	Resistance training	No	-	No	No relevant trends
Arundell 2018	ABW workplace design	No	-	No	Intervention associated with changes in perceived organisational support for being active in the workplace, workday sedentary time, exercise, and job satisfaction.
Brakenridge 2016	Organisational support	No	-	No	Significant reductions in sitting time, at

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
	plus/minus tracker				work and overall, observed for both intervention groups at 12-month follow-up only. Organisational support and tracker group improved in prolonged work sitting, standing, stepping, and overall standing at 12 months. Organisational support group improved in work prolonged sitting, time between sitting and standing time, overall prolonged sitting at 12 months, and overall standing time at both 3 and 12 months. Small, non-significant changes in health outcomes.

3.3.2.4 Certainty of evidence

We believe there is moderate-certainty evidence to support the findings for physical activity interventions. This is based on weak study designs but consistent findings.

3.3.3 Leadership support interventions

Eight studies evaluated interventions that aimed to improve health and well-being through leadership support interventions.[38-45]

3.3.3.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 18. Two studies were based in Sweden, three were based in the USA, and one each was based in Japan, Finland, and Australia.

The designs of each of the studies are reported in Table 19.

Table 18 Inclusion criteria in leadership support intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Tafvelin 2019a[38]	Sweden	101 leaders, 290 employees	Formal and informal leaders and their team members at a Swedish forest industry company with approximately 800 employees.
Lundmark 2017[39]	Sweden	541 at baseline	Managers and employees of one white-collar organisation in Sweden.
Wieneke 2016[40]	USA	2,315	Employees in a large academic medical centre in the USA, identified as having a wellness champion in their work area that had served in their role for a minimum of 1 year.
Kawakami 2005[41]	Japan	206	Employees of a computer software engineering company located in Okayama City, Japan.
Wieneke 2019[42]	USA	64,059	All employees of the Mayo Clinic.
Elo 2014[43]	Finland	145; study does not indicate how many were invited	Public sector organisation that maintains and constructs streets, green areas, and public buildings.
Jeon 2015[44]	Australia	4,233 surveys sent; 1,730 surveys returned	Middle managers.
Hammer 2011[45]	USA	360 employees at baseline	Employees of a Midwest USA grocery chain. Supervisors included store directors; assistant directors; customer service managers; assistant customer service managers; and (the predominant group) department managers in bakery, dairy/frozen, delicatessen, meat, produce, and general merchandise. A majority of the employees worked as cashiers.

Table 19 Study designs in leadership support intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Tafvelin 2019a	18 months	20 days of training over 16-month leadership training programme	Pre-post study	Transformational leadership training	Transformational leadership training incorporating multiple methodologies: 360-degree evaluation, theoretical training, practical training	Baseline measures taken before training
Lundmark 2017	13 months	13 months	Pre-post study	Web-based system for occupational health management	Web-based system for occupational health management; managers encouraged to lead discussions and create	Baseline measures taken before intervention

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					action plans to improve working conditions, system provided self-learning exercises and suggestions and support for line managers on leading improvement	
Wieneke 2016	Once-off survey	4 years	Quasi-experimental	Wellness champions programme	Wellness champions programme to extend the reach of a wellness centre to create a supportive work environment for having a healthy lifestyle; champions dedicate 1–5 hours per month to health promotion and activities	Employees not familiar with the programme
Kawakami 2005	3 months	4 weeks	RCT	Web-based supervisor training	The contents of the web-based training included a variety of topics that supervisors were required to know based on the *Guidelines for Promoting Mental Health Care in Enterprises* by the Japan Ministry of Labour, including: (a) essential knowledge about mental health, (b) importance of occupational mental health,	2-hour training session regarding a method of relaxation

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					(c) roles of supervisors in occupational mental health, (d) consultation with workers (listening and giving advice to workers, recognition of mental health problems among workers) and use of mental health services, if necessary, (e) support for workers who were returning to work after receiving treatment for mental health problems, (f) improvement of the work environment for stress prevention, and (g) self-care or awareness of stress and coping with it.	
Wieneke 2019	N/A	Unclear; programme launched in 2011 and survey conducted in 2018	Quasi-experimental	Well-being champion	The well-being champion's role is to engage their colleagues in activities that promote well-being. Champions promote health and wellness opportunities via print, electronic, and in-person communications using ready-made programme resources and are given the	No well-being champion

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					autonomy to promote programmes of personal and work group interest.	
Elo 2014	2 years	7.5 days; was carried out in residential 1–3-day sessions over a 6-month period	Quasi-experimental	Personal growth-oriented leadership intervention	Various exercises and sources of learning were applied to develop self-awareness through self-exploration. The consultants did not follow a detailed manual but rather adapted their experience to the needs of the varying situations. They aimed at choosing the succession of the techniques and exercises according to the readiness of each group in order to offer various sources for learning and enhancing reflexivity. However, it was left entirely to the participating supervisors to decide on their level of activity in the various exercises.	No intervention
Jeon 2015	18 months	12 months	RCT	Clinical Leadership in Aged Care (CLiAC)	12-month CLiAC programme	Managers in the control group received no alternative intervention
Hammer 2011	9 months	Unclear; various training	Cluster RCT	Work–family intervention	Computer-based training for supervisors,	Baseline measures, control group

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
		sessions plus 3–5 weeks of self-monitoring			followed by 1 hour of face-to-face training and 3–5 weeks of self-monitoring of six key behaviours	

3.3.3.2 Baseline characteristics

The characteristics of participants at baseline are reported in Table 20.

Table 20 Baseline characteristics in leadership support intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Tafvelin 2019a	Sweden	Formal leaders	47	-	24	6 in post, 20 in organisation
	Sweden	Informal leaders	45	-	24	6 in post, 18 in organisation
	Sweden	Team members	46	-	18	23
Lundmark 2017	Sweden	Participants with three completed questionnaires	46	-	59	-
Wieneke 2016	USA	All participants	-	-	-	-
Kawakami 2005	Japan	Web-based supervisor training	32.7	-	16	-
		Control	32.7	-	24	-
Wieneke 2019	USA	Well-being champion	44	-	80	-
		No well-being champion	45.1	-	71.5	-
Elo 2014	Finland	Personal growth-oriented leadership intervention	44.7	-	33	-
		No intervention	43.9	-	16	-
Jeon 2015	Australia	Middle managers	46.5	-	-	-
		Control group	47.1	-	-	-
Hammer 2011	USA	All participants	38	-	63	-

*Varied by outcome measure

3.3.3.3 Outcomes

3.3.3.3.1 Health and well-being

Three of the studies demonstrated an improvement in health and well-being outcomes, including job satisfaction, self-rated health, emotional exhaustion, and stress (Table 21).

Table 21 Health/well-being outcomes in leadership support intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Tafvelin 2019a	Transformational leadership training	Job satisfaction	Single-item "I am satisfied with my job" 1–5 scale	Increase associated with change in transformational leadership for formal leaders	+
		Sick leave (employee self-reported)	Total number of days absent from work due to illness in the past 6 months; 5 categories of frequency	No change	o
Lundmark 2017	Web-based system for occupational health management	Self-rated health	Single-item "How would you rate your health overall" 1–5 Likert scale	Change over time not analysed – only relationship to other variables	N/A
Wieneke 2016	Wellness champions programme	Engagement in health behaviours/programmes provided by intervention	Not specified	Statistical significance not specified	N/A
Kawakami 2005	Web-based supervisor training	Psychological distress	18-item scale from BJSQ	No significant intervention effect on psychological distress	o
Wieneke 2019	Well-being champion	Burnout	Custom item: "I feel burned out from my work"	Those with a well-being champion were significantly better off.	+
		Well-being	Custom item: "I actively make my well-being a priority"	Those with a well-being champion were significantly better off.	+
Elo 2014	Personal growth-oriented leadership intervention	Emotional exhaustion	Emotional exhaustion scale of the Maslach Burnout Inventory (range 0–6, 5 items)	No impact	o
		Stress	1 item (range 1–5, Elo *et al*., 2003)	No impact	o
Jeon 2015	CLiAC programme	Stress	The Work Stressor Index from the Work Environment Scale-R (WES-R)	No difference between intervention and control groups	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Job satisfaction	3 items from the Workforce Dynamics Questionnaire (WDQ)	No difference between intervention and control groups	o
		Intention to leave employer	4 items from the Workforce Dynamics Questionnaire (WDQ)	No difference between intervention and control groups	o
		Intention to leave profession	5 items from the Workforce Dynamics Questionnaire (WDQ)	No difference between intervention and control groups	o
Hammer 2011	Work–family intervention	Job satisfaction	5-item scale (Hackman & Oldham, 1975)	No change under intervention	o
		Physical health	SF-12 (v2) Ware, Kosinski, & Keller, 1996	Increased following intervention	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up), N/A= not applicable

3.3.3.3.2 Culture

Six of the studies demonstrated improvements in cultural change outcomes, including line managers' attitudes and actions, transformational leadership, and job demands (Table 22). One study identified a subgroup effect.[45]

Table 22 Culture outcomes in leadership support intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Tafvelin 2019a	Transformational leadership training	Transformational leadership	20-item Developmental Leadership Questionnaire (Larsson 2006)	Increased post-intervention for both formal and informal leaders	+
Lundmark 2017	Web-based system for occupational health management	Line manager attitudes and actions	Four items adapted from the Line Manager Attitudes and Actions Scale within the Intervention Process Measure (Randall 2009)	Change over time not analysed – only relationship to other variables	N/A
		Transformational leadership	Developmental Leadership Questionnaire (Larsson 2006)	Change over time not analysed – only relationship to other variables	N/A

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Wieneke 2016	Wellness champions programme	Supportive environment	Custom items: "My co-workers and I support one another in our effort to practise a healthy lifestyle" and "My organisation provides a supportive environment for its employees to live a healthy lifestyle" agreement on a 1–5 Likert scale	Higher endorsement of supportive environment questions among intervention participants	+
Kawakami 2005	Web-based supervisor training	Supervisor support	3-item 4-point Likert-type scale from the BJSQ	The intervention effect was significant	+
Wieneke 2019	Well-being champion	Meaningful work	Custom item: "The work I do is meaningful to me"	Those with a well-being champion were significantly better off	+
		Work–life balance	Custom item: "My work schedule leaves me enough time for my personal/family life"	Those with a well-being champion were significantly better off	+
		Resources available	Custom item: "Mayo Clinic provides support through resources and programmes to help me lead a healthy lifestyle (nutrition, exercise, sleep, etc.)"	Those with a well-being champion were significantly better off	+
		Teamwork	Custom item: "There is a spirit of cooperation and teamwork within my work unit"	Those with a well-being champion were significantly better off	+
		Organisational support	Custom item: "Mayo Clinic takes a genuine interest in the well-being of its employees"	Those with a well-being champion were significantly better off	+
Elo 2014	Personal growth-oriented leadership intervention	Job demands	2 items derived from the Healthy Organization Questionnaire (Lindstrom *et al.*, 1997)	No impact of intervention detected	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Job control	5 items derived from the Healthy Organization Questionnaire (Lindstrom *et al.*, 1997)	No impact of intervention detected	o
		Information flow	4 items derived from the Healthy Organization Questionnaire (Lindstrom *et al.*, 1997)	The leadership intervention improved the flow of information perceived by the subordinates whereas in the control group it remained stable	+
		Work climate	4 items derived from the Healthy Organization Questionnaire (Lindstrom *et al.*, 1997)	Work climate deteriorated in the control group but remained stable in the intervention group	o
		Support from supervisor	3 items derived from the Healthy Organization Questionnaire (Lindstrom *et al.*, 1997)	No impact of intervention detected	o
		Feedback from supervisor	3 items derived from the Healthy Organization Questionnaire (Lindstrom *et al.*, 1997)	No impact of intervention detected	o
		Justice of leadership	2 items derived from the Healthy Organization Questionnaire (Lindstrom *et al.*, 1997)	No impact of intervention detected	o
Jeon 2015	CLiAC programme	Involvement	WES-R (90 items total)	No difference in intervention and control	o
		Peer cohesion	WES-R (90 items total)	No difference in intervention and control	o
		Supervisor support	WES-R (90 items total)	Significantly better in intervention group	+
		Autonomy	WES-R (90 items total)	No difference in intervention and control	o
		Task orientation	WES-R (90 items total)	No difference in intervention and control	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Work pressure	WES-R (90 items total)	No difference in intervention and control	o
		Clarity	WES-R (90 items total)	No difference in intervention and control	o
		Control	WES-R (90 items total)	No difference in intervention and control	o
		Innovation	WES-R (90 items total)	No difference in intervention and control	o
		Physical comfort	WES-R (90 items total)	No difference in intervention and control	o
		Work Relationships Index	WES-R (90 items total)	No difference in intervention and control	o
		Transformational leadership	Multifactor Leadership Questionnaire (MLQ) eRater Form (45 items total)	Significantly better in intervention group	+
		Transactional leadership	Multifactor Leadership Questionnaire (MLQ) eRater Form (45 items total)	Significantly better in intervention group	+
		Passive avoidance leadership	Multifactor Leadership Questionnaire (MLQ) eRater Form (45 items total)	Significantly better in intervention group	+
		Leadership total	Multifactor Leadership Questionnaire (MLQ) eRater Form (45 items total)	Significantly better in intervention group	+
Hammer 2011	Work–family intervention	Family-supportive supervisor behaviours	14 items from Hammer *et al*. (2009)	Change over time not analysed – only relationship to other variables	N/A
		Work–family conflict	10 items from Netemeyer *et al*., (1996)	Change over time not analysed – only relationship to other variables	N/A

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up), N/A= not applicable

3.3.3.3.3 Association between culture and health and well-being

Three studies confirmed a mediational relationship between cultural change and health and well-being outcomes (Table 23). One study found conflicting results: the intervention had a positive effect for

workers with high levels of work–family conflict but a negative effect for those with low levels of conflict.[45] Two other studies found that culture and health/well-being outcomes aligned, although no statistical modelling was undertaken to confirm a relationship.

Table 23 Association between culture and health/well-being outcomes in leadership support intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Tafvelin 2019a	Transformational leadership training	Yes	Multigroup latent difference score analysis	Yes	Increases in transformational leadership of formal leaders (but not informal leaders) associated with improved job satisfaction. No impact for either group on use of sick leave.
Lundmark 2017	Web-based system for occupational health management	Yes	Structural equation modelling with pathway analysis	Yes	Line managers' attitudes and actions had a significant direct effect on self-rated health. Transformational leadership had a significant indirect effect on self-rated health, mediated by line managers' attitudes and actions.
Wieneke 2016	Wellness champions programme	No	-	No	Intervention participants more likely to report a supportive environment and better overall self-rated health compared with non-participants.
Kawakami 2005	Web-based supervisor training	No	-	No	No relevant trends
Wieneke 2019	Well-being champion	No	-	No	All culture and well-being measures were significantly better in the well-being champion group, but no association test was performed.
Elo 2014	Personal growth-oriented	Yes	Pearson's correlations presented. No	Yes	Emotional exhaustion and stress were positively correlated

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
	leadership intervention		further information given.		with job demands and negatively correlated with job control, information flow, work climate, supervisor support and feedback, and justice of leadership. Correlation was highest with the justice of leadership variable.
Jeon 2015	CLiAC programme	No	-	No	Change in culture measure but not health/well-being
Hammer 2011	Work–family intervention	Yes	Mediation moderation analyses	Yes	Intervention had a positive effect for workers with high levels of work–family conflict, but a negative effect for those with low levels of conflict. Employees with the highest levels of conflict reported the highest levels of health.

3.3.3.4 Certainty of evidence

We believe there is low-certainty evidence to support the findings for leadership support interventions. This is based on weak study designs and inconsistent findings.

3.3.4 Flexible working interventions

Ten studies evaluated interventions that aimed to improve health and well-being through flexible working arrangements.[46-55]

3.3.4.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 24. Six of the studies were carried out in the USA, two were carried out in Belgium, one was carried out in Germany, and one was carried out in Denmark. All studies recruited at least 78 participants. Five studies focused on white-collar workers.

Table 24 Inclusion criteria in flexible working intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Delanoeije 2020[46]	Belgium	78	Employees of a large international construction and property

Study ID	Location	No. of participants enrolled	Description of participants
			development firm headquartered in Brussels.
Hosboyar 2018[47]	USA	110	Full-time employees of a utility company in the USA.
Mache 2020[48]	Germany	103	Employees with flexible, open workplaces in a large technology company; participants had to be German-speaking office representatives, working full time, with at least 1 year of service.
Moen 2011[49]	USA	716 (approximately)	White-collar employees of corporate headquarters of a Fortune 500 retail corporation in the metropolitan Twin Cities area of Minnesota, USA.
Moen 2013a[50]	USA	659	White-collar employees of corporate headquarters of a large retail firm in Midwest USA.
Moen 2013b[51]	USA	825	White-collar workers in the Midwest headquarters of a large corporation in the USA.
Moen 2016[52]	USA	1,044	Employees and managers in the Information Technology division of a Fortune 500 corporation, which experienced a merger during the study duration.
Odle-Dusseau 2016[53]	USA	327	Employees of eight retirement communities (part of one organisation) in the mid-Atlantic region of the USA.
Pryce 2006[54]	Denmark	177	Nursing teams in a psychiatric hospital in Denmark.
Van Bogaert 2014[55]	Belgium	344	Registered nurses and midwives working in 21 clinical nursing units in a 600-bed university hospital in the Dutch-speaking part of Belgium (Flanders).

The interventions, length of study, and counterfactuals are reported in Table 25. Four studies[47,49-51] evaluated the Results-Only Work Environment (ROWE) intervention, which is designed to shift employee and supervisor focus away from time-oriented measures of success (e.g. how many hours were spent on a given project/task) in favour of a results-based appraisal of productivity with increased flexibility for employees as to where and when they work.[49] Two studies evaluated teleworking interventions.[46,47]

Table 25 Study designs in flexible working intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Delanoeije 2020	3 months	3 months	Quasi-experimental pre-post design	Teleworking intervention	Home-based telework permitted on 2 fixed days per week.	Baseline measures, usual practice control group
Hosboyar 2018	3 months	3 months	Quasi-experimen	ROWE initiative	ROWE initiative designed to	No flexibility control group

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
			tal post-test only		move employees and supervisors away from time-oriented measures of work success (e.g. how many hours put in last week; how much time spent on a given task) to a completely results-based appraisal of productivity and accomplishment. ROWE group participants were trained and informed about new work conditions, and were permitted to work from anywhere at any time as long as expectations set by managers were met. Information and training were provided.	
	13 months			Telecommuting	Telecommuting participants could work remotely during core hours. Information and training were provided.	No flexibility control group
Mache 2020	7 months	12 months	Prospective cohort study	Activity-Based Working (ABW)	Transition to ABW, incorporating use of open work offices with a variety of shared workspaces	Baseline measures

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					designed for different work tasks, which employees can use depending on the nature of their work. Desk-sharing, "neighbourhoods" to ensure team members remain in close proximity to one another, variety of information technology options.	
Moen 2011	6 months	6 months	Quasi-experimental pre-post design	ROWE initiative	ROWE initiative designed to move employees and supervisors away from time-oriented measures of work success (e.g. how many hours put in last week; how much time spent on a given task) to a completely results-based appraisal of productivity and accomplishment. Orientation for managers and four team meetings with facilitators were held in order to critique current practice and discuss new possibilities to encourage employee autonomy over work location and schedules	Baseline measures, delayed intervention

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					based on their own and the team's needs, preferences, and job responsibilities.	
Moen 2013a	6 months	6 months	Quasi-experimental pre-post design	ROWE initiative	ROWE initiative designed to move employees and supervisors away from time-oriented measures of work success (e.g. how many hours put in last week; how much time spent on a given task) to a completely results-based appraisal of productivity and accomplishment. Adoption of ROWE ways of working after four participatory workshops, led by Human Resources personnel, discussing limits of traditional time expectations and policies; then defined new work practices focusing on achieving results, encouraged to reinterpret current practices and policies as being too focused on face time.	Baseline measures, delayed intervention

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Moen 2013b	12 months	6 months	Quasi-experimental pre-post design	ROWE initiative	ROWE initiative designed to move employees and supervisors away from time-oriented measures of work success (e.g. how many hours put in last week; how much time spent on a given task) to a completely results-based appraisal of productivity and accomplishment. Orientation provided for employees, critical examination of current organisational structure and development of desired culture vision, brainstorming session with employees and managers from multiple teams to identify problems and publicise effective strategies.	Baseline measures, delayed intervention

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Moen 2016	3 months	8 hours of participatory training, 4 hours of training plus web-based training for managers, rolled out over 12 months.	Group-randomised field trial	STAR (Support. Transform. Achieve. Results.) workplace initiative	8 hours of participatory training sessions for teams and managers to identify ways to increase employees' control over work time and focus on key results more than face time at work, with changes implemented later. 4 hours of supervisor training to encourage support for personal life and professional development.	Usual practice control group
Odle-Dusseau 2016	8 months	3 hours	Pre-post study	Supervisor training for family-supportive behaviours	Once-off 3-hour face-to-face training workshop for supervisors, including educational information on the beneficial outcomes of reduced work–family conflict, information on organisational resources that reduce work–family conflict, results of baseline survey of employees' views, and definitions and examples of each of the four dimensions of family-supportive	Baseline measures

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					supervisor behaviours.	
Pryce 2006	20 months	20 months	Group-randomised controlled trial	Open rota system	1-day workshop with presentation of case studies of work-scheduling interventions; intervention groups asked to develop and implement an intervention appropriate for their team.	Baseline measures, control group
Van Bogaert 2014	7 years	1 year (approximately)	Pre-post study	Productive Ward programme	Hospital transformation process, including introduction of flat organisational structures with sufficient nurse representation in committees; participative management style with feedback from staff nurses and visible, accessible nursing leaders; positive interdisciplinary relations with mutual respect among disciplines. Productive Ward programme intended to support improvements in clinical unit care delivery within the structure of the hospital transformation process.	Baseline measures, passive productive wards (delayed implementation)

3.3.4.2 Baseline characteristics

The characteristics of participants at baseline are reported in Table 26.

Table 26 Baseline characteristics in flexible working intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Delanoeije 2020	Belgium	All participants	-	-	24.4	10.5
Hosboyar 2018	USA	Final sample	-	100	29	-
Mache 2020	Germany	All participants	-	100	53.5	-
Moen 2011	USA	All participants	32	-	48.4	4 (in organisation)
Moen 2013a	USA	All participants	-	-	-	-
Moen 2013b	USA	All participants	-	-	47	-
Moen 2016	USA	Early survey group – intervention	-	-	36	-
		Early survey group – control	-	-	38	-
		Late survey group – intervention	-	-	46	-
		Late survey group – control	-	-	32	-
Odle-Dusseau 2016	USA	Baseline participants	-	-	-	-
Pryce 2006	Denmark	All participants	43	-	92	-
Van Bogaert 2014	Belgium	Baseline participants	36.3	-	84	9.6 (in current unit)

3.3.4.3 Outcomes

3.3.4.3.1 Health and well-being

The health and well-being outcomes for the flexible working intervention studies are reported in Table 27. There were mixed findings for the ROWE interventions; while Moen *et al.,* 2011[49] and Moen *et al.,* 2013's[50,51] team-level flexibility study reported positive effects on a number of health behaviours, there was little evidence across three studies for effects on physical and mental health and well-being outcomes. Delanoeije and Verbruggen, 2020[46] reported that a teleworking intervention had an effect on general and daily stress levels, while the STAR workplace initiative had positive effects on mental health outcomes for certain participants. Mixed findings were reported for an ABW intervention[48] and for an

open-rota system in a psychiatric hospital.[54] Job satisfaction was improved through hospital organisation transformation[55] and supervisor training for family-supportive behaviours.[53]

Table 27 Health/well-being outcomes in flexible working intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Delanoeije 2020	Teleworking intervention	Trait stress	5 items adapted from the General Health Questionnaire (Goldberg and Hillier, 1979)	Significant decrease in general stress levels following teleworking intervention.	+
		Daily stress	5 items adapted from the General Health Questionnaire (Goldberg and Hillier, 1979)	Significantly lower daily stress on teleworking days when compared with office days.	+
Hosboyar 2018	ROWE initiative and telecommuting	Job satisfaction	5-item Job Satisfaction Relative to Expectations scale (Bacharach, Bamberger and Conley, 1991)	No difference between conditions.	o
		Work–life balance	Bespoke single item	Participants in ROWE condition reported stronger work–life balance than participants in teleworking or control conditions.	+
Mache 2020	ABW	Occupational stress symptoms	4-item Copenhagen Psychosocial Questionnaire	Significant decrease reported at long-term follow-up.	+
		Need for recovery	11-item Need for Recovery After Work scale (German version)	No significant change following intervention.	o
		Psychological detachment from work	4-item subscale of the Recovery Experience Questionnaire	No significant change following intervention.	o
Moen 2011	ROWE initiative	Hours of sleep per night	Bespoke single item	Increased under intervention.	+
		Exercise	Bespoke single item	Increased under intervention.	+
		Healthcare management	2-item bespoke scale	Increased under intervention.	+
		Personal mastery	Pearlin and Schooler, 1978	No significant change following intervention.	o
		Emotional exhaustion	Based on Maslach Burnout Inventory items (Maslach and Jackson, 1986)	No significant change following intervention.	o
		Psychological distress	6-item K6 (Furukawa *et al*., 2003)	No significant change following intervention.	o
		Sleep quality	1 item (Burgard and Ailshire, 2009)	No significant change following intervention.	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Self-reported health item	Bespoke single item	No significant change following intervention.	o
		Energy levels	Subset of SF-36 health survey (Ware and Sherbourne, 1992)	No significant change following intervention.	o
Moen 2013a	ROWE initiative	Self-assessed health	Bespoke single item	Direct impact of intervention not assessed; only association with other variables.	N/A
		Somatic symptoms	15-item bespoke scale	Direct impact of intervention not assessed; only association with other variables.	~
		Energy	4-item scale (Ware and Sherbourne, 1992)	Direct impact of intervention not assessed; only association with other variables.	~
		Emotional exhaustion	5-item subscale of the Maslach Burnout Inventory	Direct impact of intervention not assessed; only association with other variables.	~
		Psychological well-being	6-item scale (Ryff and Keyes, 1995)	Direct impact of intervention not assessed; only association with other variables.	~
		Personal mastery	7-item scale (Pearlin and Schooler, 1978)	Direct impact of intervention not assessed; only association with other variables.	~
		Psychological distress	Single-item scale (National Center for Health Statistics)	Direct impact of intervention not assessed; only association with other variables.	~
Moen 2013b	ROWE initiative	Smoking	Bespoke single item	Intervention participants had higher odds of quitting and decreased rate of continued smoking.	+
		Alcohol consumption	Two bespoke items	Intervention participants had lower odds of engaging in excessive drinking at follow-up.	+
		Physical activity	Bespoke single item	Intervention participants exercised more frequently at follow-up.	+
		Adequate time for sleep	Bespoke single item	Small improvement for intervention participants.	+
		Enough time for healthy meals	Bespoke single item	Improved for intervention participants.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Moen 2016	STAR workplace initiative	Emotional exhaustion	3-item subscale of the Maslach Burnout Inventory (Maslach and Jackson, 1986)	Intervention participants with baseline measures prior to being informed of merger reported significantly lower levels of burnout at long-term follow-up; no change in burnout for intervention participants with baseline measures after being informed of merger.	~+
		Perceived stress	4-item scale (Cohen *et al.*, 1983)	Intervention participants with baseline measures prior to being informed of merger reported significantly lower levels of perceived stress at long-term follow-up; no change in perceived stress for intervention participants with baseline measures after being informed of merger.	~+
		Psychological distress	6-item K6 (Kessler *et al.*, 2003)	Intervention participants with baseline measures prior to being informed of merger reported significantly lower levels of psychological distress at long-term follow-up; no change in psychological distress for intervention participants with baseline measures after being informed of merger.	~+
		Job satisfaction	3-item scale (Cammann *et al.*, 1983)	Intervention participants with baseline measures prior to being informed of merger reported significantly higher levels of job satisfaction at long-term follow-up; no change in job satisfaction for intervention participants with baseline measures after being informed of merger.	~+
Odle-Dusseau 2016	Supervisor training for family-supportive behaviours	Job satisfaction	2 items from Friedman and Greenhaus (2000) plus 2 items from the Michigan Organizational	Increase associated with intervention.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
			Assessment Questionnaire (Cammann, Fichman, Jenkins, and Klesh, 1979)		
Pryce 2006	Open rota system	Work–life balance	5-item scale	Improved following intervention relative to control group.	+
		Global self-rated health	Single-item measure (Borg and Kristensen, 2000)	No change	o
		Stress symptoms	Three 4-item scales (Setterlind and Larsson, 1995)	No change	o
		Vitality	4-item scale (Setterlind and Larsson, 1995)	No change	o
		Job satisfaction	5 items from the Copenhagen Psychosocial Questionnaire (Kristensen and Borg, 1998)	Improved following intervention relative to control group.	+
Van Bogaert 2014	Productive Ward programme	Emotional exhaustion	8-item subscale of the Maslach Burnout Inventory – Human Services Survey	Relatively stable across time points.	o
		Depersonalisation	5-item subscale of the Maslach Burnout Inventory – Human Services Survey	Relatively stable across time points.	o
		Personal accomplishment	7-item subscale of the Maslach Burnout Inventory – Human Services Survey	Relatively stable across time points.	o
		Job satisfaction	Single bespoke item	Increased across time points under active and passive (delayed) conditions.	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.4.3.2 Culture

The ROWE studies reported beneficial effects for schedule control and work–family conflict (Table 28).[47,49-51] Work–family conflict was also reduced by a teleworking intervention.[46] Mache *et al*.[48] reported evidence for improvements in some measures following a move to ABW, including improved flexible working arrangements, job autonomy and co-worker support, and reduced job demands. However, a significant and sustained increase in workload was also observed. Generally positive effects of the STAR intervention were also reported for certain participants[52] and for an open-rota system in a psychiatric

hospital.[54] Family-supportive supervisor behaviour significantly increased under a targeted intervention.[53] A hospital transformation programme had limited impact on cultural measures.[55]

Table 28 Culture outcomes in flexible working intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Delanoeije 2020	Teleworking intervention	Trait work-to-home conflict	6-item scale (Carlson *et al*., 2000)	No change over time for any condition when controlling for commuting time.	o
		Daily work-to-home conflict	4-item shortened and adapted scale based on Carlson *et al*., 2000	Employees experienced less daily work-to-home conflict on teleworking days when compared with office days.	+
Hosboyar 2018	ROWE initiative and telecommuting	Work–family conflict	8-item Work–Family Conflict Scale (Gutek, Searle and Klepa, 1991)	No difference between conditions.	o
		Work social support	10-item Work Social Support Scale (Etzion, 1984)	Analysed as moderator only.	~
Mache 2020	ABW	Flexible working arrangements	5-item scale (van Steenbergen *et al*., 2018)	Increased at 3-month follow-up, sustained at 12 months.	+
		Job demands	Copenhagen Psychosocial Questionnaire	Decreased at 3-month follow-up, sustained at 12 months.	+
		Workload	4-item subscale from the Kurzfragebogen zur Arbeitsanalyse instrument	Increased at 3-month follow-up, sustained at 12 months.	-
		Job autonomy, team collaboration	3-item subscale from the Kurzfragebogen zur Arbeitsanalyse instrument	Increased at 3-month follow-up, decreased at 12 months.	~+
		Co-worker support	3-item subscale from the Kurzfragebogen zur Arbeitsanalyse instrument	No change at 3-month follow-up, increased at 12 months.	+
		Supervisor support	3-item subscale from the Kurzfragebogen zur Arbeitsanalyse instrument	No change across time points.	o
		Satisfaction with communication climate and supervisory communication	5-item subscale from the Communication Satisfaction Questionnaire	No change across time points.	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Moen 2011	ROWE initiative	Schedule control	Modified scale (based on Thomas and Ganster, 1995)	Greater increase across time points under intervention than under control.	+
		Work–family conflict	Grzywacz and Marks (2000)	Greater decrease across time points under intervention than under control.	+
Moen 2013a	ROWE initiative	Psychological time demands	3-item scale (Siegrist *et al*., 2004)	No change under intervention.	o
		Schedule control	7-item scale (Thomas and Ganster, 1995)	Increased under intervention.	+
		Time adequacy	9-item scale, derived from Van Horn *et al*. (2001) and Becker, Stuifbergen, Soo Oh, and Hall (1993)	Increased under intervention.	+
Moen 2013b	ROWE initiative	Work–home spillover	8-item scale (Grzywacz and Marks, 2000)	Greater reduction in negative work–home spillover under intervention when compared with control group.	+
Moen 2016	STAR workplace initiative	Schedule control	8-item scale (Thomas and Ganster, 1995)	Increased under intervention.	+
		Family-supportive supervisor behaviours	4-item scale (Hammer *et al*., 2013)	Increased under intervention for participants with baseline measures prior to being informed of merger; no change for intervention participants with baseline measures after being informed of merger.	~+
		Family-to-work conflict	5-item scale (Netemeyer *et al*., 1996)	Decreased under intervention for participants with baseline measures prior to being informed of merger; no change for intervention participants with baseline measures after being informed of merger.	~+
		Work-to-family conflict	5-item scale (Netemeyer *et al*., 1996)	No change across time points following intervention.	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Variable schedule	Bespoke single item	Greater change from "not variable" to "variable" for intervention participants when compared with control participants.	+
		Hours working at home	Bespoke single item	Greater increase in working-from-home hours for intervention participants with baseline measures prior to being informed of merger compared with control participants; no change for intervention participants with baseline measures after being informed of merger.	+
Odle-Dusseau 2016	Supervisor training for family-supportive behaviours	Family-supportive supervisor behaviours	14 items from Hammer *et al*. (2009)	Significantly increased under intervention.	+
		Work–family conflict	8 items from altered Frone and Yardley (1996)	Change over time not analysed.	N/A
Pryce 2006	Open rota system	Social support	4 items from the Copenhagen Psychosocial Questionnaire (Kristensen and Borg, 1998)	Improved under intervention relative to control group.	+
		Sense of continuity	3 items from the Copenhagen Psychosocial Questionnaire (Kristensen and Borg, 1998)	Improved under intervention relative to control group.	+
Van Bogaert 2014	Productive Ward programme	Nurse–physician relations	3 items from the Revised Nursing Work Index	No change under active intervention.	o
		Nursing management at unit level	13 items from the Revised Nursing Work Index	No change under active intervention.	o
		Hospital management and organisational support	15 items from the Revised Nursing Work Index	Improved across time points under active intervention.	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up), N/A = not applicable

3.3.4.3.3 Association between culture and health and well-being

Eight studies formally assessed the link between workplace culture measures and health/well-being outcomes (Table 29), primarily using correlation matrices and regression analyses to perform mediational analysis. All eight studies confirmed an association between at least some measures. Work–family conflict or schedule control were identified as important mediators of intervention effects in six studies.[46,47,49-52]

Table 29 Association between culture and health/well-being outcomes in flexible working intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Delanoeije 2020	Teleworking intervention	Yes	Correlation matrices (pre- and post-intervention)	Yes	Work–home conflict was significantly positively correlated to stress at both baseline and follow-up.
Hosboyar 2018	ROWE initiative and telecommuting	Yes	Correlation matrix, mediational analysis using bootstrapping method and Sobel test, moderation analysis using hierarchical regression	Yes	Work–life balance significantly mediated the effects of flexible working arrangements on job satisfaction and work–family conflict. Greater work–family conflict was associated with less job satisfaction and poorer work–life balance, while greater work social support was associated with more job satisfaction and better work–life balance.
Mache 2020	ABW	Yes	Pearson correlation matrix, moderated multiple regression	Yes	Flexible working arrangements were related to lower occupational stress for those with high job autonomy. Job autonomy did not moderate the relationship between working arrangements and the need for

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
					recovery or psychological detachment from work.
Moen 2011	ROWE initiative	Yes	Structural equation modelling: four nested models tested using maximum likelihood estimation	Yes	Intervention effects on health behaviours are mediated, in whole or in part, through increases in schedule control and decreases in work–family conflict (negative work–home spillover).
Moen 2013a	ROWE initiative	Yes	Regression models of within-person change, including experimental condition as a covariate	Yes	Increases in psychological time demands predicted deterioration in all health outcomes (reduced energy, personal mastery, psychological well-being, and self-assessed health; and increased emotional exhaustion, somatic symptoms, and psychological distress). Increases in time control (schedule control and time adequacy) were associated with improved health outcomes.
Moen 2013b	ROWE initiative	Yes	Hierarchical multilevel regression analysis with individuals nested within teams; mediational model controlling for gender, job level, life events between waves, and lagged	Yes	Reduction in negative work–home spillover partially mediated intervention effects on changes in smoking, exercise frequency, and adequate time for sleep.

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
			dependent variables		
Moen 2016	STAR workplace initiative	Yes	Mixed-effects regression models with respondents nested within study groups; mediation tested using two methods	Yes	Intervention significantly impacted on well-being outcomes only for participants with baseline measures taken prior to being informed of merger. Effect on psychological distress was mediated by schedule control, family-to-work conflict, and burnout, each accounting for more than 20% of the total intervention effect on psychological distress.
Odle-Dusseau 2016	Supervisor training for family-supportive behaviours	Yes	Correlation matrix, longitudinal path modelling approach	Yes	Changes in family-supportive supervisor behaviour were positively associated with changes in job satisfaction.
Pryce 2006	Open rota system	No	-	-	Improvements in social support and sense of community reported alongside improvements in work–life balance and job satisfaction, but no formal analysis of association performed.
Van Bogaert 2014	Productive Ward programme	No	-	-	Some improvement for hospital management/organisational support and job satisfaction under active intervention, but findings were generally mixed.

3.3.4.4 Certainty of evidence

We believe there is moderate-certainty evidence to support the findings for flexible working interventions. This is based on weak study designs but consistent findings.

3.3.5 Emotional well-being interventions

Eight studies evaluated interventions that aimed to improve employees' emotional well-being.[56-63]

3.3.5.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 30.

Three studies were carried out in the USA and one each was based in the Netherlands, Korea, Germany, Finland, and Japan.

Table 30 Inclusion criteria in emotional well-being intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Crain 2019[56]	USA	823	Information technology workers in a large Fortune 500 company; participants had to be non-contract employees and located in one of the two cities where data collection took place.
Havermans 2018[57]	Netherlands	473	Employees of a large Dutch healthcare organisation.
Kim 2014[58]	Korea	211	White- and blue-collar employees of a medium-sized metal forging company.
Gregory 2018[59]	USA	112	Physicians in one of eight primary care clinics within a large, urban, integrated healthcare delivery system.
Li 2017[60]	Germany	438	Lower- and middle-level managers from the blue-collar sector of an international manufacturing plant, located in southern Germany, who were responsible for a specific unit within production and for the management of, on average, 50 workers.
Olson 2015[61]	USA	1,171	Employees at an information technology firm in the USA.
Elo 2008[62]	Finland	625 final sample (no information given on baseline sample size)	Employees of the Public Works Department of Helsinki City working in non-supervisory positions.
Kobayashi 2008[63]	Japan	1,434	Employees of a large-scale manufacturing enterprise located in western Japan.

The interventions, length of study, and counterfactuals are reported in Table 31. Interventions were varied. Three aimed to increase employees' schedule control and reduce work–family conflict.[56,57,61] Three focused specifically on stress management.[58,60,62] One was a broad, multicomponent intervention tailored to the specific needs of departments,[63] while the last study restructured work teams with the

intention of reducing workload.[59] Study designs included a number of RCTs or cluster RCTs, along with quasi-experimental pre-post studies.

Table 31 Study designs in emotional well-being intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Crain 2019	18 months	Unclear; training sessions plus 2 weeks of behaviour tracking for supervisors	Cluster RCT	Work–family intervention	Facilitated training sessions with supervisors and employees to identify new work practices and processes to increase control over work schedule and to shift performance focus to results over face time; supervisor training and behaviour tracking was conducted in order to increase supervisor support for employees' family and non-work lives.	Baseline measures, control group (usual practice)
Havermans 2018	12 months	6 months	Cluster RCT	Digital platform	Digital platform providing information, screening and planning tools, and a broad selection of interventions relevant to work stress prevention to support implementation at team level. Stepwise approach: awareness raising, assessment, planning, implementation, and evaluation.	Baseline measures, wait list control group
Kim 2014	2.5 months	2 months	Pre-post study	Comprehensive stress management programme	Participatory organisational interventions for improving the work environment and individual interventions for reinforcing coping skills for stress. Facilitator workshop, team-based	Baseline measures

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					participatory workshop using the Mental Health Action Checklist and generation of short- and long-term action plan, improvement activity check, and "Simple, inexpensive, clever" contest with feedback and short-term action plans.	
Gregory 2018	7 months	6 months	Quasi-experimental pre-post study	Workload intervention	Dyads of physician/advanced practice nurse/mental health provider and certified medical assistant replaced with work teams of two providers and three certified medical assistants who jointly managed panels of patients, effectively increasing resources by 50% and sharing responsibility for diagnosis, treatment, and care of groups of patients.	Baseline measures, control group
Li 2017	9 years	12 x 90-minute sessions of training over 2 days	RCT plus external control	Stress management training	18-hour psychotherapeutic stress management intervention, based on the Effort–Reward Imbalance (ERI) model: tackling stressor on mismatch between effort and reward and promoting recovery on overcommitment.	"Unexposed" external control group, established post hoc
Olson 2015	12 months	3 months	RCT	STAR workplace initiative	Structural and social change process designed to increase: (1) employee control over work time, and (2) family-supportive	Usual practice

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					supervisory behaviours. The change process was an integration of two interventions that, in prior evaluations, had independently addressed family-supportive supervisor behaviours and employee control, respectively. Behavioural self-monitoring activities were also integrated to support transfer of training.	
Elo 2008	2 years	2 years	Pre-post study	Stress management intervention	Participatory planning and implementation, based on participation, democratic dialogue at work, and the principles of experiential learning. Consisted of five components: 1) survey feedback process on psychosocial environment and well-being of work units, half-day sessions, and short written feedback report on work ability and emotional exhaustion provided to each employee; 2) 5-hour training sessions for supervisors to facilitate feedback process of survey results in their work unit; 3) participative conferences for setting development goals, planning and evaluating actions,	Baseline measures

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					totalling 2.5 work days, large and small group work; 4) leadership training for supervisors, 7.5 days aimed at increasing leadership justice and support and managing stress and burnout within work units; and 5) other minor interventions for all employees, voluntary attendance at lectures and guided discussions on well-being and exercise, or recreational excursions.	
Kobayashi 2008	12 months	6 months	Quasi-experimental pre-post study	Mental Health Action Checklist for a Better Workplace Environment	Work environment improvement team provided support for each department using the Mental Health Action Checklist, a list of 30 action items used to improve work environments for better worker mental health, including sharing work planning, work time and organisation, ergonomic work methods, workplace environments, mutual support at work, and preparedness and care. Planning workshop held in each department with introductory lecture, group work, and presentation and overall discussion to identify plans to be implemented in each department.	Baseline measures

3.3.5.2 Baseline characteristics

The characteristics of participants at baseline are reported in Table 32.

Table 32 Baseline characteristics in emotional well-being intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Crain 2019	USA	Intervention group	46.9	-	42.3	-
		Control group	46.6	-	37.9	-
Gregory 2018	USA	Baseline participants	-	-	-	-
Havermans 2018	Netherlands	Intervention group	44.4	-	95	-
		Control group	45.3	-	99	-
Kim 2014	Korea	Blue-collar workers	-	-	0	-
		White-collar workers	-	-	19.8	-
Li 2017	Germany	Intervention group	40.6	-	-	-
		External control	41.6	-	-	-
Olson 2015	USA	Intervention group	46.8	-	37.9	-
		Usual practice	46.6	-	42.7	-
Elo 2008	Finland	All participants	44	-	19	-
Kobayashi 2008	Japan	Intervention	-	-	9	-
		Control	-	-	11.5	-

3.3.5.3 Outcomes

3.3.5.3.1 Health and well-being

The health and well-being outcomes for the emotional well-being intervention studies are reported in Table 33. Three interventions that aimed to increase employees' schedule control and reduce work–family conflict[56,57,61] all reported positive impacts on sleep and stress outcomes. Stress management interventions[58,60,62] and broad, multicomponent interventions tailored to the specific needs of departments[63] generally did not find significant effects on health/well-being outcomes.

Table 33 Health/well-being outcomes in emotional well-being intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Crain 2019	Work–family intervention	Sleep quality and quantity	Wrist actigraphy (Philips-Respironics Actiwatch Spectrum devices)	Generally improved across time for intervention group.	+
		Self-reported sleep insufficiency	Single item, Buxton *et al*., 2009	Generally improved across time for intervention group.	+
Havermans 2018	Digital platform	Stress	Stress subscale of the Depression Anxiety and Stress Scale	Improved at follow-up for intervention group.	+
Kim 2014	Comprehensive stress management programme	Somatic symptoms	Subscale of the 26-item Worker's Stress Response Inventory (WSRI)	No significant change.	o
		Depressive symptoms	Subscale of the 26-item Worker's Stress Response Inventory (WSRI)	No significant change.	o
		Anger symptoms	Subscale of the 26-item Worker's Stress Response Inventory (WSRI)	No significant change.	o
		Work-related symptoms	Subscale of the 26-item Worker's Stress Response Inventory (WSRI)	No significant change.	o
Gregory 2018	Workload intervention	Emotional exhaustion	9-item subscale of the Maslach Burnout Inventory	Reduced following intervention.	+
		Depersonalisation	5-item subscale of the Maslach Burnout Inventory	Reduced following intervention.	+
		Self-efficacy	8-item subscale of the Maslach Burnout Inventory	No change following intervention.	o
Li 2017	Stress management training	Depression	7 items from the Hospital Anxiety and Depression Scale	Significantly more favourable in the intervention group.	+
Olson 2015	STAR workplace initiative	Total sleep time	Wrist actigraphy (Philips-Respironics Actiwatch Spectrum)	Intervention had significant positive impact at follow-up.	+
		Wake after sleep onset	Wrist actigraphy (Philips-Respironics Actiwatch Spectrum)	Intervention had a positive impact but it was not statistically significant.	+
		Sleep insufficiency	Single bespoke item	Intervention had a significant positive impact at follow-up.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Insomnia symptoms	2 items from the Pittsburgh Sleep Quality Index	Intervention had a positive impact but it was not statistically significant.	+
Elo 2008	Stress management intervention	Emotional exhaustion	General Version of the Maslach Burnout Inventory – General Survey (MBI-GS; Schaufeli, Leiter, Maslach, and Jackson, 1996)	No change.	o
		Stress symptoms	Single-item measure (Elo, Leppanen, and Jahkola, 2003)	No change.	o
Kobayashi 2008	Mental Health Action Checklist for a Better Workplace Environment	Job risk	Job Risk Assessment Diagram (JRAD)	Reduced following intervention.	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.5.3.2 Culture

The culture outcomes for the emotional well-being intervention studies are reported in Table 34. Findings were generally mixed for interventions that aimed to increase employees' schedule control and reduce work–family conflict,[56,57,61] and for stress management interventions.[58,60,62] A broad, multicomponent intervention tailored to the specific needs of departments[63] showed very few intervention effects. An intervention intended to reduce workload[59] demonstrated only a temporary effect at follow-up.

Table 34 Culture outcomes in emotional well-being intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Crain 2019	Work–family intervention	Control over work schedule	8 items based on Thomas and Ganster, 1995	Direct effect of intervention not statistically assessed, but trend increased across time points.	+
		Family-supportive supervisor behaviour	4-item scale, Hammer *et al*., 2013	Direct effect of intervention not statistically assessed, but trend appeared stable across time points.	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Work–family conflict	5-item scale, Netemeyer, Boles, and McMurrian (1996)	Direct effect of intervention not statistically assessed, but trend decreased across time points.	+
		Family time adequacy	2-item scale, Van Horn *et al*., 2001	Direct effect of intervention not statistically assessed, but trend appeared stable across time points.	o
Havermans 2018	Digital platform	Psychological demands	4-item subscale from the Job Content Questionnaire (JCQ)	No change at follow-up.	o
		Co-worker social support	5-item subscale from the JCQ	No change at follow-up.	o
		Supervisor social support	5-item subscale from the JCQ	No change at follow-up.	o
		Autonomy	3-item subscale from the JCQ	No change at follow-up.	o
Kim 2014	Comprehensive stress management programme	Physical environment	Subscale of the 43-item Korean Occupational Stress Scale (KOSS)	Improved for blue-collar workers.	+
		Job demands	Subscale of the 43-item KOSS	Improved for blue-collar workers.	+
		Insufficient job control	Subscale of the 43-item KOSS	No change.	o
		Interpersonal conflicts	Subscale of the 43-item KOSS	No change.	o
		Job insecurity	Subscale of the 43-item KOSS	No change.	o
		Organisational system	Subscale of the 43-item KOSS	Improved for blue-collar workers.	+
		Lack of rewards	Subscale of the 43-item KOSS	Improved for blue-collar workers.	+
		Organisational climate	Subscale of the 43-item KOSS	Improved for blue- and white-collar workers.	+
Gregory 2018	Workload intervention	Workload	Areas of Worklife Scale	Temporary reduction under intervention.	~+
Li 2017	Stress management training	Effort–reward ratio	Predefined ratio based on the standard short ERI questionnaire	Significantly more favourable in the experimental group.	+
		Effort	3 items from the standard short ERI questionnaire	Significantly more favourable in the experimental group.	+
		Reward	7 items from the standard short ERI questionnaire	Significantly more favourable in the experimental group.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Overcommitment	6 items from the standard short ERI questionnaire	Significantly more favourable in the experimental group.	+
Olson 2015	STAR workplace initiative	Work–family conflict	5 items (Netemeyer *et al*., 1996)	Greater improvement in work–family conflict in the intervention group than in the control group.	+
		Control over work hours	8 items (Thomas and Ganster, 1995)	Greater improvement in control over working hours in the intervention group than in the control group.	+
Elo 2008	Stress management intervention	Clarity of work goals	3-item subscale from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1997)	Improved for participants with high levels of participation.	+
		Job control	5-item subscale from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1997)	No change.	o
		Support from supervisor	3-item subscale from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1997)	No change.	o
		Feedback from supervisor	3-item subscale from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1997)	Improved for participants with high levels of participation.	+
		Justice of supervisor	2-item subscale from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1997)	No change.	o
		Flow of information	4-item bespoke scale	Improved for participants with high	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
				levels of participation.	
		Work climate	5-item bespoke scale	No change for those who participated in interventions, but deteriorated for those who did not take part.	o
Kobayashi 2008	Mental Health Action Checklist for a Better Workplace Environment	Quantitative job overload	3 items from the Brief Job Stress Questionnaire (BJSQ)	No change following intervention.	o
		Physical demands	3 items from the BJSQ	No change following intervention.	o
		Job control	1 item from the BJSQ	No change following intervention.	o
		Skill underutilisation	1 item from the BJSQ	Improved following intervention for women.	+
		Interpersonal conflict	3 items from the BJSQ	No change following intervention.	o
		Poor physical environment	1 item from the BJSQ	No change following intervention.	o
		Suitable jobs	1 item from the BJSQ	No change following intervention.	o
		Intrinsic rewards	1 item from the BJSQ	Declined following intervention for men.	-
		Supervisor support	3 items from the BJSQ	Improved following intervention for women.	+
		Co-worker support	3 items from the BJSQ	Improved following intervention for women.	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.5.3.3 Association between culture and health and well-being

Three studies formally assessed the link between workplace culture measures and health/well-being outcomes (Table 35), using general linear mixed models, correlation matrices, and multilevel structural equation modelling. All three studies confirmed that intervention effects on health/well-being outcomes were mediated by culture outcomes.[56,61,62] Of the remaining five studies, three showed roughly concordant changes in cultural and health/well-being outcomes.[59,60,63]

Table 35 Association between culture and health/well-being outcomes in emotional well-being intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Crain 2019	Work–family intervention	Yes	Restricted maximum likelihood estimation, three-level general linear mixed-model approach for cluster randomised designs. Time waves nested within participants; participants nested within workgroups. Eight condition by time means derived from fixed-effect model parameters.	Yes	Intervention brought about increases in control over work schedules, leading to more adequate family time and longer sleep duration.
Elo 2008	Stress management intervention	Yes	Correlation matrix (pre-intervention only)	Yes	At baseline, job demands, goal clarity, job control, support from supervisor, feedback from supervisor, justice from supervisor, information flow, and work climate were all significantly correlated in the expected directions with emotional exhaustion and stress.
Gregory 2018	Workload intervention	No	-	-	Temporary reduction in workload under intervention, alongside more enduring reductions in emotional exhaustion and depersonalisation.
Havermans 2018	Digital platform	No	-	-	Intervention group showed slight improvement in stress; no other effects noted.
Kim 2014	Comprehensive stress management programme	No	-	-	Some improvement in psychosocial factors but no improvement in health outcomes.

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Kobayashi 2008	Mental Health Action Checklist for a Better Workplace Environment	No	-	-	Intervention effects observed for a small number of cultural and health outcomes for women.
Li 2017	Stress management training	No	-	-	Significant benefit with intervention for all culture measures and mental well-being measures.
Olson 2015	STAR workplace initiative	Yes	Multilevel structural equation modelling	Yes	Reduced sleep insufficiency at 12 months fully mediated by increased control over work hours and reduced work–family conflict at 6 months.

3.3.5.4 Certainty of evidence

We believe there is moderate-certainty evidence to support the findings for emotional well-being interventions. This is based on weak study designs but consistent findings.

3.3.6 Participatory interventions

Twelve papers, one reporting two case studies, reported on participatory interventions.

3.3.6.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 36. Three studies were based in Canada, three were based in Denmark, three were based in Sweden, one was based in Germany, one was based in the United Kingdom (UK), and one was based in Finland.

Table 36 Inclusion criteria in participatory intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Bourbonnais 2006[25]	Canada	1,568	All care-providing personnel in a hospital.
Aust 2010[64]	Denmark	450 eligible	Employees at a large hospital were eligible for the study if they were on regular duty at the time of the baseline survey. Physicians were excluded because they were usually assigned to more than one unit.
Lavoie-Tremblay 2005[65]	Canada	60	Long-term care unit of 60 beds in a hospital centre for general and specialised care affiliated with a university.

Study ID	Location	No. of participants enrolled	Description of participants
Tafvelin 2019b[66]	Sweden	172	Hospital employees at a regional hospital.
Gilbert-Ouimet 2011[67]	Canada	1,330	White-collar workers across all six branches of an organisation in the insurance industry.
von Thiele Schwarz 2017 – Case 1[27]	Denmark	363	Mail delivery service workers in the Danish Postal Service.
von Thiele Schwarz 2017 – Case 2[27]	Sweden	381	Employees of units working directly with patients in a Swedish county district hospital.
Anderzén 2005[68]	Sweden	303	Civil servants.
Barrech 2017[69]	Germany	189	Industrial employees.
Holman 2016[70]	UK	96	Call centre employees.
Nielsen 2012[71]	Denmark	583	Employees working in elder care.
Mattila 2006[72]	Finland	525	Employees of the public works of a municipality in Finland.

Study designs of the included studies are reported in Table 37. There were five pre-post studies, four quasi-experimental studies, two cluster RCTs, and one RCT with crossover.

Table 37 Study designs in participatory intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Bourbonnais 2006	36 months	Intervention team met eight times for 3 hours over 4 months to determine intervention	Quasi-experimental	Participatory approach to reduce adverse psychosocial factors in the workplace	The intervention was defined as changes undertaken by the hospital to reduce adverse psychosocial factors in the workplace. Solutions proposed by the intervention team and adopted by the nursing department, as well as any other objective change introduced with the explicit goal (or actual consequence) of improving one of the four targeted psychosocial factors, were considered part of the intervention.	No intervention
Aust 2010	16 months	Varied, but in most units the	Quasi-experimental	Participatory intervention to improve	The intervention consisted of discussion days for	No intervention

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
		intervention phase ended after about 9 months		psychosocial work environment	all staff, employee working groups, leader coaching, and activities to improve communication and cooperation.	
Lavoie-Tremblay 2005	18 months	18 months	Pre-post study	Participatory intervention to improve psychosocial work environment	The steps of the participatory organisational intervention were: (1) commitment from the organisation; (2) identification of work constraints; (3) development of the action plans; (4) implementation of the action plans; and (5) evaluation of the action plans and follow-up.	Baseline versus subsequent time points
Tafvelin 2019b	24 months from start of intervention (baseline) to final collection of data	12 months	Pre-post study	Participatory organisational intervention for health and well-being promotion	This intervention is intentional actions in which employees and employers work together to improve employee well-being by changing the way work is organised, designed, and managed. In this case the intervention was aimed at improving the way occupational health and safety (OHS) and health promotion (HP) were conducted in the organisation.	Baseline versus subsequent time points
Gilbert-Ouimet 2011	30 months (ongoing; 7-year follow-up planned)	29 months (ongoing; 7-year follow-up planned)	Quasi-experimental	Multiple-component intervention	Intervention aimed at reducing four psychosocial work factors: high psychological demand, low decision latitude (combination of skills discretion and decision	Baseline measures taken before intervention; two external reference populations serve as controls: representativ

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					authority), low social support, and low reward. Changes chosen and implemented by managers at department level, e.g. slower implementation of large projects to manage workload; increased workforce and long-term leave replacements; organisational restructuring to group teams in order to facilitate use of expertise and promote synergy; promotion of career and skills development with conferences/training; improvement of management practices (consult, orient, coach): meetings on day-to-day matters, employee consultations (via a survey, suggestion box, etc.), and individual employee–manager meetings.	e sample of 11,485 workers in general Quebec working population and 5,879 workers employed in 20 other white-collar institutions.
von Thiele Schwarz 2017 – Case 1	12 months	12 months active (groups 1 and 2), 12 months sustainable (group 1)	Cluster RCT	Kaizen boards	Kaizen boards used to monitor and evaluate changes in a participatory intervention with a problem-solving cycle, with work teams responsible for developing and following up on action plans. Steering groups at area level to oversee overall progress.	Baseline measures, comparison wait list condition

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
von Thiele Schwarz 2017 – Case 2	24 months	21 months	Cluster RCT	Kaizen intervention	Two components: kaizen problem-solving approach to identify, plan, conduct, and evaluate issues related to psychosocial risk management; and analysis of possible consequences of all improvement suggestions for employees' well-being, with employee representatives and external consultant.	Baseline measures, control group
Anderzén 2005	12 months	12 months	Pre-post study	Psychosocial intervention programme	The programme was tailored to the needs of the unit through survey results analysis.	Baseline measures taken
Barrech 2017	7 years	Over 12 months intervention group: 2006–2007"; control group: 2007–2008	RCT with crossover	A stress management intervention (SMI), conducted as a randomised controlled study	Participants took part in a 2-day training, followed by a half-day booster session after 4 and 6 months, respectively.	Delayed intervention control
Holman 2016	11 months	11 months	Quasi-experimental	Scenario-planning method to redesign job	Using scenario-planning workshops to redesign job.	Baseline measures taken before scenario planning, t1 survey, implementation
Nielsen 2012	18 months	18 months	Pre-post study	Participatory intervention to implement teams with some degree of self-management	intervention aimed to implement teams with some degree of self-management	Baseline measures taken before implementation of teams
Mattila 2006	2 years	2.5 days	Pre-post study	Participative work conferences	Participative work conferences: 2 workdays followed	Baseline measures, control group

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					by a half-day follow-up after 6 months, with participants working in large and small groups to create visions of well-being at the workplace, recognise obstacles, set goals for developing the psychosocial work environment, and making a practical development plan for the work unit.	

3.3.6.2 Baseline characteristics

The baseline characteristics of the participatory intervention studies are provided in Table 38.

Table 38 Baseline characteristics in participatory intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Bourbonnais 2006	Canada	Participatory approach to reduce adverse psychosocial factors in the workplace	-	-	-	-
		Intervention	-	-	-	-
Aust 2010	Denmark	Participatory intervention to improve psychosocial work environment	40.6	-	96.9	7.5
		No intervention	42.2	-	99	8.3
Lavoie-Tremblay 2005	Quebec, Canada	All participants	45	51	78	-
Tafvelin 2019b	Sweden	Participatory organisational intervention	45.8	-	93.6	9.5
Gilbert-Ouimet 2011	Canada	T1 Baseline	-	-	73.1	-
		T2 6 months	-	-	63.8	-
		T3 30 months	-	-	62.7	-

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
von Thiele Schwarz 2017 – Case 1	Denmark	Intervention group	42.2	-	43.3	13.6
von Thiele Schwarz 2017 – Case 2	Sweden	Intervention group	45.8	-	93.6	19.5
		Control group	44.1	-	88	16.8
Anderzén 2005	Sweden	Civil servants	18–24 years: 15%; 35–44 years: 24%; 45–54 years: 35%; 55 years and over: 26%	78	22	-
Barrech 2017	Germany	Industrial employees	41.46	-	0	-
Holman 2016	UK	Call centre employees	31.5	-	54	2
Nielsen 2012	Denmark	Employees working in elder care	-	-	-	-
Mattila 2006	Finland	Intervention group	44.2	-	25	-
		Control 1 (same department)	43.8	-	13	-
		Control 2 (different department)	45	-	15	-

3.3.6.3 Outcomes

3.3.6.3.1 Health and well-being

Six studies demonstrated a direct impact of the interventions on health and well-being measures, including burnout, job satisfaction, and self-rated health.

Table 39 Health/well-being outcomes in participatory intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Bourbonnais 2006 (1-year time point)	Participatory approach to reduce adverse psychosocial factors in the workplace	Psychological distress	14 items from the Psychiatric Symptom Index (PSI)	More favourable in the experimental group.	+
		Sleeping problems	Five questions from the Nottingham Health Profile	More favourable in the	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
				experimental group.	
		Client-related burnout	Questions from the Copenhagen Burnout Inventory	More favourable in the experimental group.	+
		Work-related burnout	Questions from the Copenhagen Burnout Inventory	Significantly more favourable in the experimental group.	+
		Personal burnout	Questions from the Copenhagen Burnout Inventory	More favourable in the experimental group.	+
Bourbonnais 2006 (3-year time point)	Participatory approach to reduce adverse psychosocial factors in the workplace	Emotional demands	Nursing Stress Scale	Less favourable in the experimental group.	-
		Psychological distress	14 items from the Psychiatric Symptom Index (PSI)	More favourable in the experimental group.	+
		Sleeping problems	Five questions from the Nottingham Health Profile	More favourable in the experimental group.	+
		Client-related burnout	Questions from the Copenhagen Burnout Inventory	Significantly more favourable in the experimental group.	+
		Work-related burnout	Questions from the Copenhagen Burnout Inventory	Significantly more favourable in the experimental group.	+
		Personal burnout	Questions from the Copenhagen Burnout Inventory	Significantly more favourable in the experimental group.	+
Aust 2010	Participatory intervention to improve psychosocial	Mental health	Short-form 36-items (SF-36)	No change in mental health between the groups.	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
	work environment				
		Vitality	Short-form 36-items (SF-36)	Vitality increased in the intervention group approaching statistical significance.	+
Lavoie-Tremblay 2005	Participatory intervention to improve psychosocial work environment	Psychological distress	Psychiatric Symptom Index (PSI)	No significant impact.	o
		Absenteeism rate	Absenteeism rate (hours lost/hours worked). This indicator was compiled using the health institution management computerised control system.	Decrease in absenteeism rate of healthcare workers in the unit targeted by the intervention, during and 1 year after the intervention, compared with stability in the absenteeism rate for the entire healthcare institution.	+
Tafvelin 2019b	Participatory organisational intervention	Job satisfaction	1-item Hlegren et al. 1997	No clear trend	o
		Work ability	3-items (Dallner et al., 2000; Tuomi, Ilmarinen, Jahkola, Katajarinne, & Tulkki, 1998)	No clear trend	o
Gilbert-Ouimet 2011	Multiple-component intervention	Cardiovascular risk factors	Not specified.	Not analysed.	N/A
		Weight	Not specified.	Not analysed.	N/A
		Height	Not specified.	Not analysed.	N/A
		Waist circumference	Not specified.	Not analysed.	N/A
		Musculoskeletal symptoms	Nordic Questionnaire (Kuorinka *et al.*, 1987)	Decreased at follow-up.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Psychological distress	Psychiatric Symptom Index (PSI) (Ilfeld, 1976)	Decreased at follow-up.	+
von Thiele Schwarz 2017 – Case 1	Kaizen boards	Mental health	5 items from Ware and Gandek (1998)	Change over time not analysed – only relationship to other variables.	N/A
		Job satisfaction	Custom single-item measure	Change over time not analysed – only relationship to other variables.	N/A
von Thiele Schwarz 2017 – Case 2	Kaizen intervention	Global job satisfaction	3 items from Hellgren *et al*. (1997)	Change over time not analysed – only relationship to other variables.	N/A
		Discomfort with work	Custom single-item measure	Change over time not analysed – only relationship to other variables.	N/A
Anderzén 2005	Psychosocial intervention programme	Work-related exhaustion	Quality Work Competence (QWC) indices	Significant improvement	+
		Employee well-being	QWC indices	Significant improvement	+
		Sleep quality	QWC indices	Significant improvement	+
		Self-rated health	QWC indices	No significant improvement	o
		Cholesterol (mmol/L)	-	Significant improvement	+
		Triglyceride (mmol/L)	-	Significant improvement	+
		Cortisol (nmol/L)	-	Significant improvement	+
		Prolactin (µg/L)	-	No significant improvement	o
		Testosterone (nmol/L)	-	Significant improvement	+
Barrech 2017	A stress management intervention (SMI), conducted as a randomised controlled study	Anxiety	German version of the Hospital Anxiety and Depression Scale (HADS-D) (7 items)	Reduction	+
		Depression	German version of the Hospital Anxiety and Depression	Reduction	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
			Scale (HADS-D) (7 items))		
Holman 2016	Scenario-planning method to redesign job	Psychological contract fulfilment	Robinson and Rousseau (1994) single-item measure	Not directly assessed.	N/A
		Well-being	Warr's (1990) 12-item measure of well-being	Not directly assessed.	N/A
Nielsen 2012	Participatory intervention to implement teams with some degree of self-management	Affective well-being	Affective well-being (5 items) (Bech, Olsen, Kjoller, and Rasmussen, 2003)	Not directly assessed.	N/A
		Job satisfaction	5 items from Kristensen, Hannerz, Høgh, and Borg, 2005	Not directly assessed.	N/A
Mattila 2006	Participative work conferences	Emotional exhaustion	General Version of the Maslach Burnout Inventory – General Survey (MBI-GS; Schaufeli, Leiter, Maslach, and Jackson, 1996)	No change	o
		Stress symptoms	Single-item measure (Elo, Leppanen, and Jahkola, 2003)	No change	o

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up), N/A= not applicable

3.3.6.3.2 Culture

Seven studies demonstrated a direct impact of the interventions on a very large range of cultural change measures, including effort–reward imbalance, job control, and organisational change capacity (Table 40).

Table 40 Culture outcomes in participatory intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Bourbonnais 2006 (1-year time point)	Participatory approach to reduce adverse psychosocial factors in the workplace	Psychological demands	9 items from Karasek's Job Content Questionnaire (JCQ)	Significantly more favourable in the experimental group.	+
		Decision latitude	9 items from Karasek's JCQ	No significant difference	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
				between groups. Both decreased.	
		Supervisor support	8 items from Karasek's JCQ	Significantly more favourable in the experimental group.	+
		Co-worker support	8 items from Karasek's JCQ	More favourable in the experimental group.	+
		Reward	11 items from Siegrist's original instrument	Significantly more favourable in the experimental group.	+
		Effort–reward imbalance	Psychological demands were used as a proxy for effort. The effort–reward imbalance was defined as a ratio of effort to reward greater than 1 as recommended by Siegrist.	Significantly more favourable in the experimental group.	+
Bourbonnais 2006 (3-year time point)	Participatory approach to reduce adverse psychosocial factors in the workplace	Psychological demands	9 items from Karasek's JCQ	Significantly more favourable in the experimental group.	+
		Decision latitude	9 items from Karasek's JCQ	Significantly more favourable in the experimental group.	+
		Supervisor support	Part of total support	Significantly more favourable in the experimental group.	+
		Co-worker support	Part of total support	More favourable in the experimental group.	+
		Total support	8 items from Karasek's JCQ	Significantly more favourable in the experimental group.	+
		Reward	11 items from Siegrist's original instrument	Significantly more favourable in the experimental group.	+
		Effort–reward imbalance	Psychological demands were used as a proxy for effort. The effort–reward imbalance was	Significantly more favourable in the experimental group.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
			defined as a ratio of effort to reward greater than 1 as recommended by Siegrist.		
Aust 2010	Participatory intervention to improve psychosocial work environment	Quantitative demands	Copenhagen Psychosocial Questionnaire, version 1 (COPSOQ 1)	Intervention had no statistically significant impact.	o
		High work pace	COPSOQ 1	Intervention had no statistically significant impact.	o
		Emotional demands	COPSOQ 1	Intervention had no statistically significant impact.	o
		Demands for hiding emotions	COPSOQ 1	Intervention had no statistically significant impact.	o
		Influence	COPSOQ 1	Intervention had no statistically significant impact.	o
		Possibilities for development	COPSOQ 1	Intervention had no statistically significant impact.	o
		Meaning of work	COPSOQ 1	Intervention had a statistically significant negative impact.	-
		Social support from colleagues	COPSOQ 1	Intervention had no statistically significant impact.	o
		Social support from supervisor	COPSOQ 1	Intervention had a statistically significant negative impact.	-
		Role clarity	COPSOQ 1	Intervention had no statistically significant impact.	o
		Role conflicts	COPSOQ 1	Intervention had no statistically significant impact.	o
		Predictability	COPSOQ 1	Intervention had no statistically significant impact.	o
		Quality of leadership	COPSOQ 1	Intervention had a statistically significant negative impact.	-
Lavoie-Tremblay 2005	Participatory intervention to improve	Reward	Effort–Reward Questionnaire	Significant increase in	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
	psychosocial work environment		(Niedhammer and Siegrist, 1998)	reward post-intervention.	
		Effort–reward imbalance	Effort–Reward Questionnaire (Niedhammer and Siegrist, 1998)	Significant decrease in effort–reward imbalance post-intervention.	+
		Psychological demand	JCQ (Karasek, 1985; Karasek and Theorell, 1990)	No significant difference.	o
		Job strain	JCQ (Karasek, 1985; Karasek and Theorell, 1990)	No significant difference.	o
		Decision latitude	JCQ (Karasek, 1985; Karasek and Theorell, 1990)	No significant difference.	o
		Social support from colleagues	4 items from Karasek's (1985) JCQ instrument	No significant difference.	o
		Social support from superiors	4 items from Karasek's (1985) JCQ instrument	Significant decrease in social support from superiors post-intervention.	-
Tafvelin 2019b	Participatory organisational intervention	Perceived line manager support	4-item scale, custom	Increased over time	+
		Employee perception of participation	4-item scale, custom	No clear trend over time	o
Gilbert-Ouimet 2011	Multiple-component intervention	Psychological demand	Subscale of French version of the Karasek JCQ (Laroque *et al.*, 1998)	High scores decreased at follow-up.	+
		Decision latitude	Subscale of French version of the Karasek JCQ (Laroque *et al.*, 1998)	No change	o
		Social support from colleagues	Subscale of French version of the Karasek JCQ (Laroque *et al.*, 1998)	Low scores decreased at follow-up.	+
		Social support from supervisors	Subscale of French version of the Karasek JCQ (Laroque *et al.*, 1998)	No change	o
		Reward	French version of Siegrist's 11 items (2003)	Low scores decreased at follow-up.	+
		Effort	French version of Siegrist's 2 items (2003)	No change reported.	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Effort–reward ratio	French version of Siegrist's scales	No change	o
von Thiele Schwarz 2017 – Case 1	Kaizen boards	Improved psychosocial risk management	7-item bespoke measure	Change over time not analysed – only relationship to other variables.	N/A
von Thiele Schwarz 2017 – Case 2	Kaizen intervention	Integration of organisational and employee objectives	4-item bespoke scale	Change over time not analysed – only relationship to other variables.	N/A
Anderzén 2005	Psychosocial intervention programme	Work climate	QWC indices	No significant improvement	o
		Work tempo	QWC indices	No significant improvement	o
		Performance feedback	QWC indices	Significant improvement	+
		Participatory management	QWC indices	Significant improvement	+
		Employeeship	QWC indices	Significant improvement	+
		Skill development	QWC indices	Significant improvement	+
		Goal clarity	QWC indices	No significant improvement	o
		Efficiency	QWC indices	Significant improvement	+
		Leadership	QWC indices	Significant improvement	+
		Focus score/organisations' change capacity	QWC indices	No significant improvement	o
Barrech 2017	A stress management intervention (SMI), conducted as a randomised controlled study	Effort–reward ratio	German version of the ERI scale (23 items total)	Significantly decreased.	+
		Effort	6 items from the German version of the ERI scale	Significantly decreased.	+
		Reward: esteem	5 items from the German version of the ERI scale	Significantly increased.	+
		Reward: promotion	4 items from the German version of the ERI scale	Significantly increased.	+
		Reward: job security	2 items from the German version of the ERI scale	Significantly increased.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Overcommitment	6 items from the German version of the ERI scale	Significantly decreased.	+
Holman 2016	Scenario-planning method to redesign job	Job control	6-item measure (Jackson *et al*.)	Not directly assessed.	N/A
		Feedback	5-item measure (Holman)	Not directly assessed.	N/A
Nielsen 2012	Participatory intervention to implement teams with some degree of self-management	Changes in procedures	Custom 4-item measure	Not directly assessed.	N/A
		Employee participation	Custom 3-item measure	Not directly assessed.	N/A
		Social support	2 items from Kristensen, Hannerz, Høgh, and Borg, 2005	Not directly assessed.	N/A
Mattila 2006 Effect of a participative work conference on psychosocial work environment and well-being	Participative work conferences	Job control	5 items from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1998)	No change under intervention.	o
		Work climate	5 items from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1998)	No change under intervention; deterioration in one control group.	o
		Clarity of work goals	3 items from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1998)	No change under intervention.	o
		Supervisor support	3 items from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1998)	No change under intervention.	o
		Flow of information	4 items from the Healthy Organization Questionnaire (Lindström, Hottinen, Kivimäki, and Länsisalmi, 1998)	Improved under intervention.	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up), N/A= not applicable

3.3.6.3.3 Association between culture and health and well-being

Seven studies confirmed a mediational relationship between health and well-being outcomes and cultural change for a variety of measures (Table 41).

Table 41 Association between culture and health/well-being outcomes in participatory intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Bourbonnais 2006 (1-year time point)	Participatory approach to reduce adverse psychosocial factors in the workplace	No	-	No	Most measures of culture and measures of mental well-being were favourable in the experimental group, but no formal association test was performed.
Bourbonnais 2006 (3-year time point)	Participatory approach to reduce adverse psychosocial factors in the workplace	No	-	No	Most measures of culture and measures of mental well-being were favourable in the experimental group, but no formal association was test performed.
Aust 2010	Participatory intervention to improve psychosocial work environment	No	-	No	No relevant trends
Lavoie-Tremblay 2005	Participatory intervention to improve psychosocial work environment	No	-	No	Mixed trends
Tafvelin 2019b	Participatory organisational intervention	Yes	Path-analysis	Yes	Perceived line manager's support predicted employee participation which translated into job satisfaction. There was no evidence of correlation for work ability

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Gilbert-Ouimet 2011	Multiple-component intervention	No	-	-	General improvement in health outcomes, accompanied by improvement in psychological demand, social support from colleagues, and reward.
von Thiele Schwarz 2017 – Case 1	Kaizen boards	Yes	Multi-group structural equation modelling with path analysis. Differences in paths assessed using the chi-square test.	Yes	Use of kaizen boards predicted improved psychosocial risk management, which in turn predicted improved mental health and job satisfaction.
von Thiele Schwarz 2017 – Case 2	Kaizen intervention	Yes	As for Case 1	Yes	Intervention impacted on job satisfaction and discomfort with work through integration of objectives using kaizen.
Anderzén 2005	Psychosocial intervention programme	Yes	Pearson correlation and forward stepwise linear regression modelling	Yes	There is an association among the psychosocial work environment, employee self-rated health and well-being, and biologic stress markers.
Barrech 2017	A stress management intervention (SMI), conducted as a randomised controlled study	Yes	Multivariate linear regression analyses	Yes	Changes in all elements of culture between baseline and post-intervention follow-up were significantly associated with lower anxiety 7 years later.
					Changes in effort/reward ratio between baseline and post-intervention follow-up were significantly associated with lower depression 7 years later.
Holman 2016	Scenario-planning method to redesign job	Yes	Multiple mediator/multiple outcome model that included all independent,	Yes	Job redesign intervention influenced a broad range of employee outcomes (employee well-being,

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
			mediating, and dependent variables.		job performance, and psychological contract fulfilment) by inducing change in multiple job characteristics (job control and feedback).
Nielsen 2012	Participatory intervention to implement teams with some degree of self-management	Yes	Pathway structural equation model	Yes	Pre-intervention levels of autonomy and job satisfaction predicted the degree of employee participation in the planning and implementation of the intervention. In turn, participation and changes in work procedures were significantly associated with post-intervention autonomy, social support, and well-being.
Mattila 2006	Participative work conferences	No	-	No	Few changes under intervention for both culture measures and health/well-being outcomes.

3.3.6.4 Certainty of evidence

We believe there is moderate-certainty evidence to support the findings for participatory interventions. This is based on weak study designs but consistent findings.

3.3.7 Military mental health interventions

Six studies evaluated interventions that aimed to improve mental health outcomes in military recruits.[73-78]

3.3.7.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 42. Four of the studies were carried out in the USA, one was carried out in Canada, and one was carried out in the UK. All studies recruited more than 1,000 participants. Three studies focused on personnel returning from combat and three focused on personnel who were in their initial training.

Table 42 Inclusion criteria in military mental health intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Adler 2009[73]	USA	2,297	Study participants were active-duty US soldiers in a brigade combat

Study ID	Location	No. of participants enrolled	Description of participants
			team returning from a 12-month combat deployment to Iraq.
Mulligan 2012[74]	UK	2,661	Members of the UK armed forces just returning from deployment in Afghanistan. The study aimed to recruit personnel exposed to potentially traumatic combat events while deployed; therefore, personnel from units known not to have been deployed outside the main base headquarters were excluded.
Castro 2012[75]	USA	1,645	Active-duty US soldiers in a brigade combat team who had returned from a 12-month combat deployment to Iraq 4 months earlier.
Williams 2007[76]	USA	1,199	Navy recruits who underwent a 9-week period of basic training at Great Lakes Naval Recruit Training Command.
Wyman 2020[77]	USA	1,897	US airforce personnel in training assigned to classes at the Technical Training School, Sheppard Air Force Base, Wichita Falls, Texas, between October 2017 and October 2019.
Fikretoglu 2019[78]	Canada	3,227	Canadian Armed Forces military recruits

The interventions, length of study, and counterfactuals are reported in Table 43. Three studies evaluated variations of the Battlemind training intervention, which is designed to aid armed forces personnel who are returning from combat. The remaining three studies evaluated interventions that attempted to better prepare recruits mentally for entering the armed forces. All studies were RCTs.

Table 43 Study designs in military mental health intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Adler 2009	4 months	~1 hour	RCT	Battlemind debriefing	Battlemind debriefing addresses potential criticisms of debriefing. While Battlemind debriefing briefly acknowledges that difficult events occurred during combat, it minimises the degree to which events are recounted, thus addressing concerns about retraumatising or exposing others to secondary trauma. Instead, Battlemind	Stress education

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					debriefing emphasises the transition from combat to home, and recognises that this transition is a critical social–psychological task.	
				Small Battlemind training	18–45 individuals per group. Battlemind training takes a cognitive and skills-based approach to educating military personnel about post-deployment transition. Training reviews specific skills that served individuals in combat, but that need to be adapted for the transition home. By building upon existing skills, Battlemind training reframes transition difficulties and reinforces adaptive cognitions, thus incorporating elements from positive psychology.	Stress education
				Large Battlemind training	126–225 individuals per group. The intervention was the same for small Battlemind training psychology.	Stress education
Mulligan 2012	6 months	~1 hour	RCT	Large Battlemind training	Anglicised form of post-deployment Battlemind training, delivered to groups of approximately 100.	Standard brief
Castro 2012	6 months	40–79 minutes	RCT	Battlemind training 3–6 months post-deployment	One of three Battlemind modules	Survey only
Williams 2007	9 weeks	Weekly over 9 weeks	RCT	BOOT STRAP	BOOT Camp Survival Training for Navy Recruits—A Prescription (BOOT STRAP): cognitive-behavioural approach of the BOOT STRAP intervention focused on stress and emotionality, problem solving, stress management, changing thinking associated with depressive symptoms, sense of belonging, and	No intervention

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					team building within the division.	
Wyman 2020	6 months	Three 90- to 120-minute blocks over 3 consecutive days, booster 1-hour review after 1 month	RCT	Wingman-Connect	Adapted from a suicide prevention programme used in public education settings (Sources of Strength). The Wingman-Connect programme used group skill building for cohesion, shared purpose, and managing career and personal stressors (three blocks of 2 hours each). Stress management training covered cognitive and behavioural strategies (2 hours). Both conditions had a 1-hour booster session, plus text messages.	Stress management training
Fikretoglu 2019	9 weeks for each group	160-minute classroom session	RCT	Road to Mental Readiness (R2MR)	R2MR at Basic Military Qualification (BMQ) has three objectives: 1) to increase mental health literacy; 2) to teach stress management skills; and 3) to change attitudes and intentions towards mental health service use.	Delayed intervention control

3.3.7.2 Baseline characteristics

The characteristics of participants at baseline are reported in Table 44.

Table 44 Baseline characteristics in military mental health intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Adler 2009	USA	Stress education	-	-	4.9	-
	USA	Battlemind debriefing	-	-	2.8	-
	USA	Small Battlemind training	-	-	6.2	-
	USA	Large Battlemind training	-	-	3.1	-
Mulligan 2012	UK	Large Battlemind training	-	-	1.1	5.5
	UK	Standard brief	-	-	2.2	5.4
Castro 2012	USA	Battlemind 3–6 months post-deployment	-	-	4.87	-

	USA	Survey only	-	-	3.81	-
Williams 2007	USA	BOOT STRAP	19.9	-	23.5	-
	USA	No intervention	19.6	-	25.5	-
Wyman 2020	USA	Wingman-Connect	-	-	17.1	-
	USA	Stress management training	-	-	17	-
Fikretoglu 2019	Canada	R2MR	23.4	-	13.47	0
	Canada	Delayed R2MR (control)	23.4	-	15.5	0

3.3.7.3 Outcomes

3.3.7.3.1 Health and well-being

The health and well-being outcomes for the military mental health intervention studies are reported in Table 45. There were mixed and contradictory findings for the Battlemind studies, and combat exposure was identified as a treatment effect modifier. Williams *et al*. reported mixed findings for stress outcomes, but improvements in emotional reactivity.[76] The Wingman-Connect intervention had a positive effect on suicidal ideation at 1 month, but this impact was not sustained to the 6-month follow-up point.[77] The R2MR intervention improved health-seeking behaviour only.[78]

Table 45 Health/well-being outcomes in military mental health intervention studies

Study	Intervention	Outcome	Measure/scale	Direction of effect	
Adler 2009	Battlemind training	Post-traumatic stress disorder (PTSD)	17-item PTSD Checklist	There was no significant impact of any Battlemind intervention versus control on PTSD.	o
		Depression	9-item Patient Health Questionnaire (PHQ) for Depression	Battlemind training led to fewer depression symptoms than did stress education.	+
		Sleep	Custom 4-item questionnaire	There was no significant impact of any Battlemind intervention versus control on sleep.	o
Mulligan 2012	Battlemind training	PTSD	The 17-item PTSD Checklist – Civilian Version	There was no effect of study arm on PTSD.	o
		Symptoms of common mental disorders	12-item General Health Questionnaire	There was no effect of study arm on symptoms of common mental disorders.	o
		Depression	9-item Patient Health Questionnaire (PHQ)	There was no effect of study arm on depression.	o

Study	Intervention	Outcome	Measure/scale	Direction of effect	
		Sleep quality	3 items adapted from the US Battlemind study (Adler, Bliese, McGurk *et al*., 2009)	There was no effect of study arm on sleep in the main analysis. However, when adjusted for combat exposure, those in the Battlemind arm scored significantly better than those in the standard brief.	+
		Alcohol use	World Health Organization's Alcohol Use Disorders Identification Test (10 items)	Borderline significant effect of Battlemind intervention on alcohol use in the main analysis. However, when adjusted for combat exposure, those in the Battlemind arm scored significantly better than those in the standard brief.	+
Castro 2012	Battlemind training 3–6 months post-deployment	PTSD	17-item PTSD Checklist	Fewer PTSD symptoms with Battlemind training.	+
		Depression	9-item Patient Health Questionnaire (PHQ) for Depression	Fewer depression symptoms with Battlemind training.	+
		Life satisfaction	5-item Satisfaction With Life Scale (Pavot and Diener, 1993)	Better life satisfaction with Battlemind training.	+
Williams 2007	BOOT STRAP	Perceived stress (past month)	14-item Perceived Stress Scale	No significant differences between the intervention arms at 9 weeks.	o
		Depression	21-item Beck Depression Inventory, Second Edition (BDI-II)	No significant differences between the intervention arms at 9 weeks.	o
		Perceived average degrees of emotional reactivity (past week)	Custom 0–100 scale	Significantly lower self-assessed emotional reaction in intervention group.	+
		Perceived average stress level (past week)	Custom 0–100 scale	Significantly lower self-assessed stress levels in intervention group.	+
Wyman 2020	Wingman-Connect	Suicidal ideation severity	Suicide scale (CAT-SS) of the Computerized	Participants in Wingman-Connect programme had significantly lower	~+

Study	Intervention	Outcome	Measure/scale	Direction of effect	
			Adaptive Test for Mental Health	suicidal ideation severity at 1-month follow-up, but not at 6-month follow-up.	
		Depression	Depression scale (CAT-DI) of the Computerized Adaptive Test for Mental Health	At 1-month and 6-month follow-up, Wingman-Connect participants reported significantly lower depression symptoms.	+
Fikretoglu 2019	R2MR	Psychological functioning	Group of items from: the Kessler Psychological Distress Scale (K-10), the Subjective Units of Distress Scale (SUDS), the Patient Health Questionnaire, the Generalized Anxiety Disorder Scale (GAD-7), and the abbreviated Connor-Davidson Resilience Scale	No difference in groups.	o
		Test of Performance Strategies	Test of Performance Strategies (Thomas *et al*., 1999)	No difference in groups.	o
		Help-seeking behaviour	Custom question	Increased help-seeking behaviour in intervention group.	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.7.3.2 Culture

The three Battlemind studies assessed the impact of the intervention on stigma surrounding mental health and found no significant effect. Williams *et al*.[76] and Wyman *et al*.[77] found that their interventions had a significant impact on all measures of culture assessed, including cohesion. Fikretoglu *et al*. found that the intervention did not impact on attitudes towards mental health[78].

Table 46 Culture outcomes in military mental health intervention studies

Study	Intervention	Outcome	Measure/scale	Direction of effect	
Adler 2009	Battlemind training	Stigma	5-item scale (Hoge *et al*., 2004)	There was no significant impact of any Battlemind intervention versus control on stigma.	o
Mulligan 2012	Battlemind training	Stigma	8-item scale adapted from a measure used in US military research (Hoge *et al*., 2004)	No significant effect	o
Castro 2012	Battlemind training 3–6 months post-deployment	Stigma	5-item version of the stigma scale (Hoge *et al*., 2004)	No significant effect	o
Williams 2007	BOOT STRAP	Perceived cohesion	Perceived Cohesion Scale	Intervention group recruits developed significantly higher group cohesion.	+
		Social support	Interpersonal Relationship Inventory	The intervention recruits perceived more social support than the control recruits.	+
		Conflict in relationships	Interpersonal Relationship Inventory	Intervention group reported less conflict in relationships.	+
Wyman 2020	Wingman-Connect	Class cohesion	3 items from Podsakoff and Mackenzie, 1994	Participants in the intervention arm fared significantly better.	+
		Class morale	1 item from Britt and Dickinson, 2005	Participants in the intervention arm fared significantly better.	+
		Healthy class norms	Custom 5-item measure	Participants in the intervention arm fared significantly better.	+
		Bonds to classmates	Bonds to classmates were assessed by asking each participant to name classmates (up to 5) whom they respect and would choose to spend time with.	Participants in the intervention arm fared significantly better.	+
Fikretoglu 2019	R2MR	Attitude	Canadian Armed Forces Mental Health Service Use Questionnaire	No statistically significant difference in attitude between groups at either time point.	o

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.7.3.3 Association between culture and health and well-being

Five of the six studies of military mental health interventions did not formally assess whether there was a link between workplace culture measures and health/well-being outcomes (Table 47). Through statistical modelling, Wyman *et al*. found that the trainee air force personnel's perceptions of being embedded in a more cohesive, healthy class accounted for significant portions of Wingman-Connect's impact on reducing suicidal ideation and depression symptoms.[77] Although Williams *et al*. did not carry out a formal analysis of the association between culture and health/well-being outcomes, culture measures (perceived cohesion, social support, and conflict in relationships) were seen to be linked to the intervention, as were two measures of well-being (stress and emotion reactivity).[76]

Table 47 Association between culture and health/well-being outcomes in military mental health intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Adler 2009	Battlemind training	No	-	No	No relevant trends; no significant change in culture measures and only one change in health/well-being outcomes.
Mulligan 2012	Battlemind training	No	-	No	No relevant trends; no significant change in culture measures, but improvements in two measures of health/well-being.
Castro 2012	Battlemind training 3–6 months post-deployment	No	-	No	No relevant trends; no significant change in culture measures, but improvements in all measures of health and well-being.
Williams 2007	BOOT STRAP	No	-	No	Positive trends for culture measures and measures of stress, but no association analysis performed.

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Wyman 2020	Wingman-Connect	Yes	Two-level mediation models using the product of coefficients method	Yes	Participants' perceptions of being embedded in a more cohesive, healthy class accounted for significant portions of Wingman-Connect's impact on reducing suicidal ideation and depression symptoms.
Fikretoglu 2019	R2MR	No	-	No	No relevant trends; no significant change in culture measures, but improvements in one well-being outcome.

3.3.7.4 Certainty of evidence

We believe there is low-certainty evidence to support the findings for military mental health interventions. This is based on weak study designs and inconsistent findings.

3.3.8 Unique interventions

Six studies evaluated interventions that were conceptually unique or distinct from the other groupings of interventions presented above.[79-84]

3.3.8.1 Study design

The location, number of participants, and individual study eligibility criteria are reported in Table 48.

Two studies were conducted in the USA, and one each in Finland, Denmark, Canada, and Norway. All studies recruited at least 110 participants. Five of the six studies focused on staff in social or health services; two of these studies were based in hospitals.

Table 48 Inclusion criteria in unique intervention studies

Study ID	Location	No. of participants enrolled	Description of participants
Kukkurainen 2012[79]	Finland	114	Multidisciplinary team members of a Finnish hospital (excluding physicians and administrative and ancillary staff).

Study ID	Location	No. of participants enrolled	Description of participants
Neves 2018[80]	USA	290	Employees and their supervisors at a social service organisation in the Mid-Atlantic region of the USA.
Nielsen 2009[81]	Denmark	551	Staff working within the elderly care department of a large Danish local government organisation.
Seidel 2017[82]	USA	246	Employees of a local authority for behavioural health and developmental disabilities in Austin, Texas, USA.
Steele Gray 2015[83]	Canada	125	Employees of a hospital in a major metropolitan city in Canada.
Vaag 2013[84]	Norway	472	Employees of a Norwegian municipality.

The interventions, length of study, and counterfactuals are reported in Table 49. All six interventions were conceptually distinct. Two studies were repeated cross-sectional surveys, two were longitudinal studies, and two were quasi-experimental studies.

Table 49 Study designs in unique intervention studies

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
Kukkurainen 2012	Approximately 2 years	Approximately 2 years	Longitudinal study	Organisational vision	3-year staff development plan included vision statements.	Baseline measures
Neves 2018	-	-	Quasi-experimental	Timesizing	Reduced work hours instead of layoffs.	Control group (non-timesized sites in same organisation)
Nielsen 2009	18 months	-	Repeated cross-sectional study	Permanent teams	Teams established such that a group of employees was jointly responsible for a group of clients, with regular team meetings and external team managers.	Baseline measures
Seidel 2017	18 months	12 months	Longitudinal survey study	Tobacco-free campus	Tobacco-free campus policy with assessment of staff tobacco use and attitudes, policy	Baseline measures

Study ID	Study time frame	Length of exposure	Study design	Intervention short name	Intervention full description	Counterfactual
					communication, staff education and training, and provision of cessation resources.	
Steele Gray 2015	12 months	6 months	Repeated cross-sectional study	Physical redevelopment of a hospital and shifts in operational and organisational processes	Physical redevelopment of hospital environment, revolutionary organisational change, along with implementation of change management processes to reduce resistance, build resilience, and improve employee adjustment, including leadership and governance changes, stakeholder engagement, communication, workflow analysis and integration, training, education, monitoring, and evaluation.	Baseline measures
Vaag 2013	13 weeks	11 sessions and final concert over 3 months	Quasi-experimental pre-post study	Sound of well-being choir singing intervention	Recruitment to amateur choir with 11 rehearsals outside work hours and a final concert	Baseline measures, control group (non-participants in choir intervention)

3.3.8.2 Baseline characteristics

The characteristics of participants at baseline are reported in Table 50.

Table 50 Baseline characteristics in unique intervention studies

Study ID	Location	Group	Mean age (years)	Full-time employees (%)	Females (%)	Average tenure (years)
Neves 2018	USA	All participants	40	78	55	4.7
Seidel 2017	USA	Baseline	-	-	76.4	-
Vaag 2013	Norway	Total sample	-	67.2	75.8	-
		Participants	-	65.4	81.3	-
		Non-participants	-	71.3	63.8	-
Kukkurainen 2012	Finland	All participants	43	-	"Mostly female"	12
Steele Gray 2015	Canada	All participants	-	89.8	85.2	-
Nielsen 2009	Denmark	All participants	44	-	93	12

3.3.8.3 Outcomes

3.3.8.3.1 Health and well-being

The health and well-being outcomes for the unique intervention studies are reported in Table 51.

The introduction of a tobacco-free campus was associated with reductions in tobacco use,[82] and a choir singing intervention was associated with improved work engagement and self-perceived global health among women.[84] Physical redevelopment and changes in organisational processes at a hospital were associated with improved satisfaction, but no other health or well-being changes were observed.[83]

Table 51 Health/well-being outcomes in unique intervention studies

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
Seidel 2017	Tobacco-free campus	Tobacco use ever	Not specified	Decreased under intervention.	+
		Tobacco use at work	Not specified	Decreased under intervention.	+
		Desire to quit smoking	Single bespoke item	Results not analysed for statistical significance.	~
		Seriously considering quitting smoking	Single bespoke item	Results not analysed for statistical significance.	~
		Smoking quitting attempts	Single bespoke item	Not examined at baseline.	~
Vaag 2013	Sound of well-being choir singing intervention	Work engagement	9-item version of the Utrecht Work Engagement Scale (Schaufeli *et al.*, 2002)	Increased among women under intervention.	+

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Self-perceived global health	Single bespoke item	Increased under intervention.	+
Kukkurainen 2012	Organisational vision	Stress/strain at work	Single bespoke item	Change over time not studied, only relationship to other variable. Association with vision statement at end of follow-up confirmed.	~
		Work satisfaction	Single bespoke item	Change over time not studied, only relationship to other variable. Association with vision statement at end of follow-up confirmed.	~
Nielsen 2009	Permanent teams	Job satisfaction	5 items from the Copenhagen Psychosocial Questionnaire (COPSOQ; Kristensen, Hannerz, Hogh, and Borg, 2006)	No significant improvement	o
		Well-being	5 items from the COPSOQ (Kristensen, Hannerz, Hogh, and Borg, 2006)	No significant improvement	o
Neves 2018	Timesizing	Emotional exhaustion	5-item scale (Schaufeli, Leiter, Maslach, and Jackson, 1996)	No direct effect of intervention	o
		Stress appraisal due to timesizing	4 items adapted from Terry, Tonge, and Callan (1995)	No direct effect of intervention	o
Steele Gray 2015	Physical redevelopment of a hospital and shifts in operational and organisational processes	Satisfaction	15-item bespoke scale	Significant increase at follow-up compared to baseline.	+
		Satisfaction: facility	Bespoke facility-specific satisfaction index	Significant increase at follow-up compared to baseline.	+
		Workplace burnout	22-item Maslach Burnout Inventory – Revised	No change	o

Study ID	Intervention	Outcome	Measure/scale	Direction of effect	
		Personal accomplishment	Subscale of the Maslach Burnout Inventory – Revised	No change	o
		Emotional exhaustion	Subscale of the Maslach Burnout Inventory – Revised	No change	o
		Depersonalisation	Subscale of the Maslach Burnout Inventory – Revised	No change	o
		Optimism	6-item Revised Life Orientation Test (Scheier, Carver, and Bridges, 1994)	No change	o
		General well-being	8-item scale, not specified	No change	o

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.8.3.2 Culture

The culture outcomes for the unique intervention studies are reported in Table 52. Results were generally mixed across the studies, with only the tobacco-free campus intervention demonstrating a consistent change in measures of culture over time.[82]

Table 52 Culture outcomes in unique intervention studies

Study	Intervention	Outcome	Measure/scale	Direction of effect	
Seidel 2017	Tobacco-free campus	Policy support	Bespoke single item	Increased across time points.	+
		Willingness to enforce the policy	Bespoke single item	Increased across time points.	+
Vaag 2013	Sound of well-being choir singing intervention	Job demand	Job Content Questionnaire (JCQ), formative indices according to the Demand, Control and Support model (Karasek and Theorell, 1990)	Increased under intervention among men.	-
		Job control	JCQ, formative indices according to the Demand, Control and Support model (Karasek and Theorell, 1990)	Increased among women under intervention.	+

Study	Intervention	Outcome	Measure/scale	Direction of effect	
		Job support	JCQ, formative indices according to the Demand, Control and Support model (Karasek and Theorell, 1990)	No change	o
Kukkurainen 2012	Organisational vision	Vision of the organisation	5-item bespoke scale	No change over time	o
Nielsen 2009	Permanent teams	Social support	3 items from the Copenhagen PsychoSocial Questionnaire (Kristensen, Hannerz, Hogh, & Borg, 2006)	No change over time	o
		Meaningful work	3 items from the Copenhagen PsychoSocial Questionnaire (Kristensen, Hannerz, Hogh, & Borg, 2006)	No change over time	o
		Role clarity	3 items from the Copenhagen PsychoSocial Questionnaire (Kristensen, Hannerz, Hogh, & Borg, 2006)	No change over time	o
Neves 2018	Timesizing	Role of middle manager	7-item scale, not specified	Not assessed statistically.	~
		Social support	3 items from the COPSOQ (Kristensen, Hannerz, Hogh, and Borg, 2006)	No significant change	o
Steele Gray 2015	Physical redevelopment of a hospital and shifts in operational and organisational processes	Meaningful work	3 items from the COPSOQ (Kristensen, Hannerz, Hogh, and Borg, 2006)	No significant change	o
		Role clarity	3 items from the COPSOQ (Kristensen, Hannerz, Hogh, and Borg, 2006)	No significant change	o
		Perceived organisational support	8-item scale (Eisenberger *et al.*, 1986; Shore and Tetrick, 1991)	Not assessed individually, only in relation to other variables.	~

Study	Intervention	Outcome	Measure/scale	Direction of effect	
		Organisational readiness: self-prepared	Bespoke scale, not specified	Dipped from baseline immediately prior to move, but increased following move at follow-up.	~+
		Organisational readiness: organisation prepared	Bespoke scale, not specified	Dipped from baseline prior to and after move, but increased at follow-up.	~+
		Organisational readiness: support by managers	Bespoke scale, not specified	No change across time points	o
		Organisational readiness: support by colleagues	Bespoke scale, not specified	Improved steadily from prior to move through to follow-up.	+
		Organisational readiness: perceived threat/worry	Bespoke scale, not specified	No change until long-term follow-up, when a significant reduction was observed.	+
		Organisational readiness: activities prepared and training prepared	Bespoke scale, not specified	Ratings improved over time as the move date got further away.	+
		Interprofessional interactions	8-item bespoke scale	Significant increase at follow-up compared to baseline.	+

Note: Direction of effects symbols: + = beneficial effect of intervention; - = detrimental effect of intervention; o = no effect of intervention; ~ = qualified effect of intervention or some caveat applies (e.g. temporary effect not sustained at follow-up)

3.3.8.3.3 Association between culture and health and well-being

Four of the six studies formally assessed the link between workplace culture measures and health/well-being outcomes (Table 53) using chi-square, Fisher's exact test, hierarchical linear modelling, structural equation modelling, and analysis of variance (ANOVA). All four studies confirmed an association between at least some measures. Two studies confirmed a mediating effect of organisational or supervisor support.[80,81]

Table 53 Association between culture and health/well-being outcomes in unique intervention studies

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
Kukkurainen 2012	Organisational vision	Yes	Chi-square/Fisher's exact test	Yes	Vision statement correlated with experience of stress, work satisfaction, and general empowerment at the end of the follow-up period.
Neves 2018	Timesizing	Yes	Correlation matrix; hierarchical linear modelling, grand-mean centred, multilevel with employees nested under supervisors	Yes	Timesizing proximity was positively related to stress only when perceived organisational support was low; this relationship was absent when perceived organisational support was high. Timesizing proximity effect on emotional exhaustion was mediated by stress.
Nielsen 2009	Permanent teams	Yes	Structural equation modelling with pairwise deletion, maximum likelihood method with covariance method as input	Yes	Middle managers' active involvement in implementing the change partially mediated the relationship between working conditions at time 1 and time 2. Working conditions at time 2 were in turn related to time 2 job satisfaction and well-being. These results suggest that the degree to which employees perceive their middle managers to play an active role in implementing change is related to intervention outcomes.
Vaag 2013	Sound of well-being choir singing intervention	No	-	No	Mixed effects on organisational commitment, work engagement, job demands, and job control, along gender lines.
Seidel 2017	Tobacco-free campus	No	-	No	Significant reductions in tobacco use and

Study ID	Intervention	Culture–health association statistically assessed?	Statistical analysis	Statistical association between culture and health measures?	Summary
					increase in support for policy over time.
Steele Gray 2015	Physical redevelopment of a hospital and shifts in operational and organisational processes	Yes	Separate 2 (time period baseline to follow-up) x 2 (high versus low organisational readiness) between-subject analysis of variances (ANOVAs) run for each domain of organisational readiness on employee outcomes	Yes	All seven domains of readiness were significantly related to increases in workplace satisfaction. Facility satisfaction increased for those with high perceived self- and organisational preparedness.

3.3.8.4 Certainty of evidence

We did not assign a grade of evidence to the unique interventions group as the interventions within this group are not considered comparable.

3.4 Cultural drivers

Question 2: What factors drive this influence on health and well-being?

To address Question 2, we analysed the data according to the cultural drivers that were seen across intervention groups to act as mediators between the intervention and health and well-being outcomes (Figure 6). We only considered studies that tested a statistical model of this pathway in this analysis. Twenty-six studies statistically assessed the role of organisational culture as a mediator and every one of these studies found a statistically significant relationship. In this pathway, there were 26 unique cultural drivers and 23 health and well-being outcomes.

Figure 6 Mediation pathway

To be considered key cultural drivers, culture outcomes needed to meet two criteria: (1) show mediation relationships with three health and well-being outcomes, and (2) show mediation relationships with health and well-being outcomes in at least two separate studies. Only key cultural drivers are discussed in this section. Figure 7 shows that the key cultural drivers are job control, information flow, job demands,

organisational support, work climate, work–family conflict, supervisor support, line managers' attitudes and actions, justice of leadership, and feedback. The numbers shown are the number of mediation relationships identified.

Job control and work–family conflict were the most commonly reported cultural drivers. Mediation effects were in the expected directions, such that improvements in each of the cultural driver outcomes corresponded to improvements in health outcomes (e.g. good organisational support was associated with lower sickness absence).

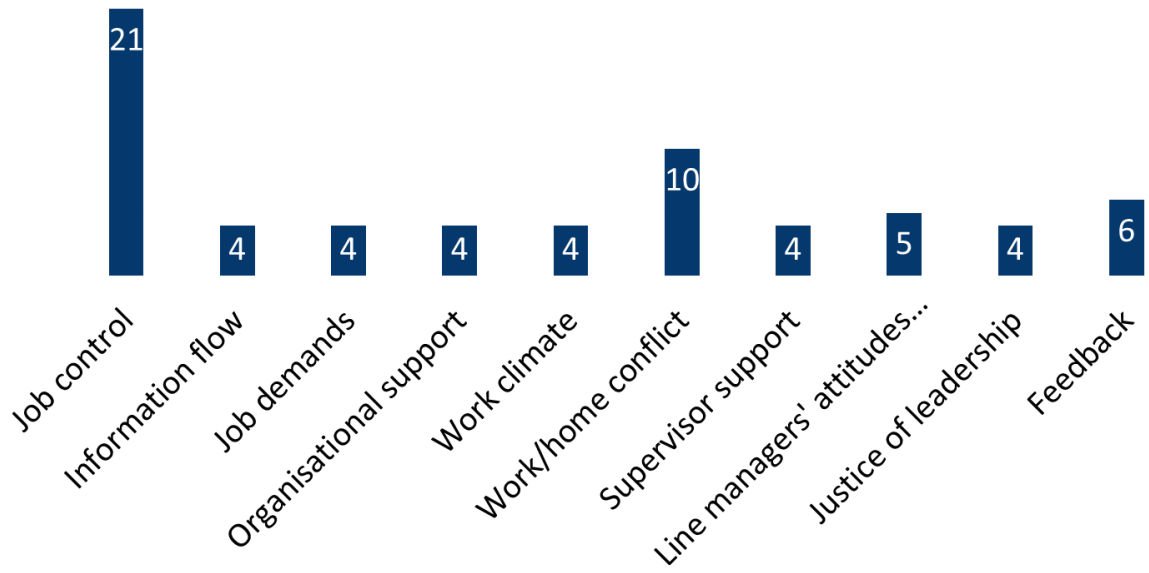

Figure 7 Key cultural drivers by number of mediation relationships

Job control was seen to mediate the impact of 4 intervention categories on 14 outcomes, as outlined in Table 54. Emotional exhaustion, sleep quality, and stress were the outcomes that were most commonly linked to job control as a cultural driver.

Table 54 Summary of job control as a cultural driver

Intervention groups	Mediation	Health/well-being outcomes	Number of studies that found mediation effect	Synonyms
4 intervention categories Emotional well-being Leadership support Flexible working Participatory interventions	Job control as mediator →	**14 outcomes** Biologic stress markers Emotional exhaustion (burnout) Energy Exercise Healthcare management More adequate family time	9 studies[43,48-50,52,56,61,62,70]	Autonomy Schedule control

Intervention groups	Mediation	Health/well-being outcomes	Number of studies that found mediation effect	Synonyms
		Personal mastery Psychological distress Psychological well-being Psychological contract fulfilment Self-rated health Sleep quality Stress Well-being		

Information flow, job demands, work climate, supervisor support, and justice of leadership were seen to mediate the same pathway (Table 55). These cultural factors were seen to mediate the relationship between emotional well-being and leadership support interventions and the outcomes of emotional exhaustion and stress.

Table 55 Summary of information flow, job demands, work climate, supervisor support, and justice of leadership as cultural drivers

Intervention groups	Mediation	Health/well-being outcomes	Number of studies that found mediation effect	Synonyms
2 intervention categories Emotional well-being Leadership support	 Information flow Job demands Work climate Supervisor support Justice of leadership as mediators	**2 outcomes** Emotional exhaustion (burnout) Stress	2 studies[43,62]	N/A

Organisational support was seen to mediate the influence of overarching health promotion and unique interventions on emotional exhaustion, sick leave, stress, and well-being (Table 56).

Table 56 Summary of organisational support as a cultural driver

Intervention groups	Mediation	Health/well-being outcomes	Number of studies that found mediation effect	Synonyms
2 intervention categories Overarching health promotion Unique interventions	Organisational support as mediator 	**4 outcomes** Emotional exhaustion Sick leave Stress Well-being	3 studies[28,29,80]	N/A

Work–family conflict was seen to act as a mediator between flexible working and emotional well-being interventions and seven health and well-being outcomes (Table 57). Sleep quality was the outcome most commonly linked to work–family conflict as a mediator.

Table 57 Summary of work–family conflict as a cultural driver

Intervention groups	Mediation	Health/well-being outcomes	Number of studies that found mediation effect	Synonyms
2 intervention categories Flexible working Emotional well-being	Work–family conflict as mediator →	**7 outcomes** Exercise Healthcare management Job satisfaction Psychological distress Sleep quality Smoking Stress	6 studies[46,47,49,51,52,61]	Work/home balance

Feedback was seen to act as a mediator between three intervention categories and four health and well-being outcomes (Table 58).

Table 58 Summary of feedback as a cultural driver

Intervention groups	Mediation	Health/well-being outcomes	Number of studies that found mediation effect	Synonyms
3 intervention categories Participatory interventions Leadership support Emotional well-being	Feedback as mediator →	**4 outcomes** Emotional exhaustion Psychological contract fulfilment Stress Well-being	3 studies[43,62,70]	N/A

Line managers' attitudes and actions were seen to act as a mediator between three intervention categories and four health and well-being outcomes (Table 59).

Table 59 Summary of line managers' attitudes and actions as a cultural driver

Intervention groups	Mediation	Health/well-being outcomes	Number of studies that found mediation effect	Synonyms
3 intervention categories	Line managers' attitudes and	**4 outcomes**	4 studies[28,29,39,81]	N/A

Leadership support Overarching health promotion Unique interventions	actions as mediator →	Job satisfaction Self-rated health Sick leave Well-being

4 Discussion

4.1 Summary of findings

This systematic review identified 60 studies for inclusion. Most of the studies were concentrated in the USA (19 studies), with good representation from Canada (5 studies) and the Nordic countries (6 in Sweden, 5 in Finland, 5 in Denmark, and 1 in Norway). Australia, the Netherlands, Japan, Germany, the UK, Belgium, and Korea were also represented, with the final study being based across the USA and Canada.

First, we assessed whether a culture of health and well-being in an organisation influences the health and well-being of workers. We sorted studies into eight intervention groups: overarching health promotion interventions, physical activity interventions, leadership support interventions, flexible working interventions, emotional well-being interventions, participatory interventions, military mental health interventions, and a group of studies focused on unique interventions that did not fall into any other category.

Five studies examined large-scale, multicomponent health promotion programmes in workplaces with the aim of improving employee health and well-being by offering resources, guidance, and activities.[28-32] Four of the studies demonstrated effects on a range of health and well-being outcomes, including improvements in health behaviours (e.g. dietary habits, physical activity, sedentary behaviour, and tobacco use), as well as in physical and mental health measures. Three studies demonstrated effects on culture change measures, including bonding social capital, organisational support, and positive supervisor attitudes towards their role in health promotion. Two studies used statistical modelling to confirm that culture outcomes – specifically organisational support and positive supervisor attitudes – mediated the intervention effects on sickness absence and well-being.

Five studies examined interventions to encourage physical activity.[33-37] Four of these studies demonstrated effects on a range of health and well-being outcomes, including improvements in health behaviour (e.g. daily steps, activity level, and perceived changes in sitting) and well-being outcomes (e.g. vigour and workplace satisfaction). Four studies demonstrated effects on culture change measures, particularly around organisational and management support. None of the studies explored the statistical association between cultural change and health and well-being outcomes.

Eight studies evaluated interventions that aimed to improve health and well-being through leadership support.[38-45] Three of the studies demonstrated an improvement in health and well-being outcomes, including job satisfaction, self-rated health, emotional exhaustion, and stress. Six of the studies demonstrated improvements in cultural change outcomes, including line managers' attitudes and actions, transformational leadership, and job demands. Three studies confirmed a mediational relationship between cultural change and health and well-being outcomes.

Ten studies evaluated interventions that aimed to improve health and well-being through flexible working arrangements.[46-55] Nine studies demonstrated an improvement in health and well-being outcomes, particularly job satisfaction and psychological distress, and nine studies demonstrated an improvement on a wide range of cultural change measures, particularly schedule control and work–family conflict. Seven studies confirmed a mediational relationship between a number of cultural change measures and health and well-being outcomes.

Eight studies evaluated interventions that aimed to improve the emotional well-being of workers.[56-63] Six demonstrated an improvement in health and well-being outcomes, particularly measures of sleep, depression, and stress. Seven demonstrated an impact on cultural change, including job demands and

work–family conflict. Two studies confirmed that changes in sleep were mediated by schedule control and work–family conflict.

Twelve studies (two of these reported in the same paper) evaluated participatory interventions; these were interventions in which all participants were involved in making and carrying out decisions about the development of the intervention.[26,27,64-72] Six studies demonstrated a direct impact of the interventions on health and well-being measures, including burnout, job satisfaction, and self-rated health. Six studies demonstrated a direct impact of the interventions on a very large range of cultural change measures, including effort–reward imbalance, job control, and organisational change capacity. Six studies confirmed a mediational relationship between health and well-being outcomes and cultural change for a variety of measures.

Six studies evaluated interventions that aimed to improve mental health outcomes in military recruits.[73-78] Three studies evaluated the Battlemind training programme, with mixed and contradictory findings, although some studies found evidence for improvement in PTSD and depression symptoms, with combat exposure identified as a modifier of the treatment effect. Three other interventions also demonstrated mixed findings, with some identified effects on help-seeking behaviour, depression, and stress. Cultural changes were demonstrated for measures of perceived group cohesion, social support, and class morale. One study confirmed that participants' perceptions of being embedded in a cohesive, healthy class contributed to reduced suicidal ideation and depression symptoms.

Six additional studies evaluated interventions that were conceptually unique or distinct from the other groupings of interventions presented above.[79-84] Three studies confirmed a mediational relationship between health and well-being outcomes and cultural change: perceived organisational support mediated the impact of exposure to time sizing on stress; the impact of implementing permanent teams on job satisfaction was mediated by the active involvement of middle managers; and perceived readiness for organisational change mediated the impact of physical redevelopment and shifts in operational and organisational processes on workplace satisfaction.

Second, in order to determine what cultural factors drive this influence on health and well-being, we analysed the data considering culture measures as a mediator between the intervention and the health and well-being outcomes.

The majority of studies used some form of multilevel modelling for the analysis, although mediation analysis, pathway modelling, structural equation modelling, correlation analysis, and multigroup latent difference score analysis were also undertaken.

We identified ten key cultural drivers: job control, information flow, job demands, organisational support, work climate, work–family conflict, supervisor support, line managers' attitudes and actions, justice of leadership, and feedback. Job control and work–family conflict were the most commonly reported cultural drivers. Mediation effects were in the expected directions, such that improvements in each of the cultural driver outcomes corresponded to improvements in health outcomes (e.g. good organisational support was associated with lower sickness absence).

Job control was seen to mediate the impact of 4 intervention categories (emotional well-being, leadership support, flexible working, and participatory interventions) on 14 health and well-being outcomes. Information flow, job demands, work climate, supervisor support, and justice of leadership were seen to mediate the pathway between emotional well-being and leadership support interventions and the outcomes of emotional exhaustion and stress. Organisational support was seen to mediate the influence of overarching health promotion and unique interventions on emotional exhaustion, sick leave, stress, and well-being. Work–family conflict was seen to act as a mediator between flexible working and

emotional well-being interventions and seven health and well-being outcomes. Feedback was seen to act as a mediator between three intervention categories (participatory interventions, leadership support, and emotional well-being) and four health and well-being outcomes. Line managers' attitudes and actions were seen to act as a mediator between three intervention categories (leadership support, overarching health promotion, and unique interventions) and four health and well-being outcomes.

We used the Effective Public Healthcare Panacea Project's Quality Assessment Tool for Quantitative Studies to critically appraise the included studies.[23]

One study was rated as having strong methodological quality, 10 studies were rated as having moderate methodological quality, and 49 were rated as having weak mythological quality. The included studies had mixed study designs, such as RCTs, cluster RCTs, quasi-experimental, and pre-post study designs. Selection bias and poor blinding commonly led to studies being downgraded. Most studies utilised strong data collection methods by using established tools with good validity and reliability.

Certainty about the evidence was assessed using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach.[24] We believe there is low- to moderate-certainty evidence to support the findings for the influence of interventions. This is based on weak study designs and sometimes inconsistent findings.

4.2 Comparison to existing literature

To our knowledge, four reviews carried out work similar to ours, all of which reflected our findings. Flynn *et al*. completed a systematic review where they investigated the evidence base for elements of a culture of health.[85] They identified 24 elements in all, akin to our 26 cultural factors, and highlighted that the supportive built environment, policies and procedures, and communications were the three most frequently measured elements. However, it is worth noting that the authors restricted their study selection criteria to a predetermined list of culture of health elements, and employed a rather narrow definition of a culture of health. This means that they may have missed more generic evidence connecting culture to other health outcomes.[85]

Kent *et al*. carried out a literature review with the aim of identifying key success elements of employer-sponsored health promotion programmes.[86] The results echoed those of our review, citing that the key elements that contribute to a culture of health are leadership commitment, social and physical environmental support, and employee involvement or participation.[86]

Gray *et al*. conducted a realist review of workplace-based organisational interventions promoting mental health and happiness among healthcare workers.[87] Although they limited their search regarding health outcomes, the authors discovered similar results to our review in relation to the importance of employee engagement or participation in the intervention development and implementation process.[87]

As with Gray *et al*., a systematic review by Taylor *et al*. focused on one health outcome in the exploration of organisational culture and sedentary behaviour in the workplace.[88] In parallel with our findings, they recommended identifying what matters most for changing how employees think and feel about the organisation's support for health and reducing sedentary behaviour. They highlighted potential targets such as policies, environmental supports, and clear and favourable upper- and middle-management communication.[88]

4.3 Strengths and limitations

This is the first systematic review we are aware of that examines culture as a mediator between healthy workplace interventions and health and well-being outcomes.

The inclusion of controlled experimental study designs acts as a strength in this review, as they can rigorously test the hypotheses of interest and establish clear causal links. However, the exclusion of qualitative and mixed-method study designs can also be viewed as a limitation, given that not all cultural factors of interest might have been examined in an intervention and qualitative data may provide further context in this area.

Another limitation of this study is that only 26 of the 60 included studies statistically examined the role of culture in driving health and well-being outcomes.

4.4 Future research

In addition to mediation relationships that have been statistically confirmed by study authors, we have highlighted trends where cultural change and changes in health outcomes co-occur in studies, suggesting associations between these variables. These associations warrant future investigation in primary studies.

Future research using robust, recognised, qualitative methodologies would also prove helpful to the field, in providing rich context to understand the cultural drivers that may mediate health and well-being in the workplace.

Dependent on the availability of data, future reviews would benefit from the consideration of evidence from quantitative, qualitative, and mixed-method design research in tandem to gain a broader understanding of workplace culture.

4.5 Conclusions

Health and well-being outcomes across a wide range of workplace interventions are mediated by workplace culture change. Key cultural drivers identified are job control, information flow, job demands, organisational support, work climate, work–family conflict, supervisor support, line managers' attitudes and actions, justice of leadership, and feedback. Workplace interventions can be designed with these cultural factors in mind in order to achieve health and well-being outcomes.

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87. Gray P, Senabe S, Naicker N, et al. Workplace-Based Organizational Interventions Promoting Mental Health and Happiness among Healthcare Workers: A Realist Review. *Int J Environ Res Public Health*. 2019;16(22).
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Appendix A **PRISMA-S checklist**

Section/topic	#	Checklist item	Location(s) Reported
INFORMATION SOURCES AND METHODS			
Database name	1	Name each individual database searched, stating the platform for each. Medline, CINAHL, SocIndex (EBSCO) PsycINFO (OVID)	Methods chapter & Appendices
Multi-database searching	2	If databases were searched simultaneously on a single platform, state the name of the platform, listing all of the databases searched.	n/a
Study registries	3	List any study registries searched.	n/a
Online resources and browsing	4	Describe any online or print source purposefully searched or browsed (e.g., tables of contents, print conference proceedings, web sites), and how this was done.	Methods chapter & Appendices
Citation searching	5	Indicate whether cited references or citing references were examined, and describe any methods used for locating cited/citing references (e.g., browsing reference lists, using a citation index, setting up email alerts for references citing included studies).	Methods chapter & Appendices
Contacts	6	Indicate whether additional studies or data were sought by contacting authors, experts, manufacturers, or others.	n/a
Other methods	7	Describe any additional information sources or search methods used.	n/a
Full search strategies	8	Include the search strategies for each database and information source, copied and pasted exactly as run.	Methods
Limits and restrictions	9	Specify that no limits were used, or describe any limits or restrictions applied to a search (e.g., date or time period, language, study design) and provide justification for their use.	Methods
Search filters	10	Indicate whether published search filters were used (as originally designed or modified), and if so, cite the filter(s) used.	Methods chapter

Section/topic	#	Checklist item	Location(s) Reported
Prior work	11	Indicate when search strategies from other literature reviews were adapted or reused for a substantive part or all of the search, citing the previous review(s).	n/a
Updates	12	Report the methods used to update the search(es) (e.g., rerunning searches, email alerts).	n/a
Dates of searches	13	For each search strategy, provide the date when the last search occurred.	Appendices
Peer review	14	Describe any search peer review process.	Methods chapter
Total Records	15	Document the total number of records identified from each database and other information sources.	Prisma Flow diagrams in Methods chapter
Deduplication	16	Describe the processes and any software used to deduplicate records from multiple database searches and other information sources.	Methods chapter

PRISMA-S: An Extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews

Rethlefsen ML, Kirtley S, Waffenschmidt S, Ayala AP, Moher D, Page MJ, Koffel JB, PRISMA-S Group.

Appendix B Database and journal search parameters

Database	Platform	Database coverage	Date of search	Results
Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to September 09, 2020	Ovid	Inception-present	10 September 2020	3,547
CINAHL Complete	EBSCO	Inception-present	10 September 2020	1,278
SocINDEX	EBSCO	Inception-present	10 September 2020	902
APA PsycInfo 1806 to September Week 1 2020	Ovid	1806-present	14 September 2020	959
Journal of Occupational and Environmental Medicine American Journal of Health Promotion	Lippincott publisher platform	2005-present	20 August 2020	55
American Journal of Health Promotion		2005-present	20 August 2020	38

Supplemental searches	Results
Included Studies (screened from 29 Systematic Reviews; see Appendix D)	462
Studies retrieved from reference searching and citation chasing of included studies	1,588

Appendix C **Search strategy**

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
N	Terms	*N*	Terms	*N*	
					Terms
1	(cultur* adj1 health).kf,tw.	S1	(MH "Case Studies")	1	case report/
2	(cultur* adj3 health adj3 (wellbeing or well-being or wellness)).kf,tw.	S2	(MH "Qualitative Studies+")	2	Qualitative Research/
3	(organi#ation adj1 cultur* adj3 (health or wellbeing or well-being or wellness)).kf,tw.	S3	TI qualitative W1 research OR AB qualitative W1 research	3	qualitative research*.mp.
4	(support* adj1 (leader* or cultur* or Organi#ation* or environment*)).kf,tw.	S4	TI "qualitative stud*" OR AB "qualitative stud*"	4	qualitative stud*.mp.
5	(psychosocial adj work* adj environment).kf,tw.	S5	TI "action research" OR AB "action research"	5	action research.mp.
6	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (strateg* or polic*)).kf,tw.	S6	(MH "Action Research")	6	action research.mp.
7	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 cultur*).kf,tw.	S7	TI "participatory research" OR AB "participatory research"	7	participatory research.mp.
8	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (climate* or morale)).kf,tw.	S8	TI "case stud*" OR AB "case stud*"	8	case stud*.mp.
9	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 ethos).kf,tw.	S9	TI ethno* OR AB ethno*	9	ethno*.mp.
10	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 leader*).kf,tw.	S10	TI "grounded theory" OR AB "grounded theory"	10	grounded theory.mp.
11	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 value*).kf,tw.	S11	TI phenomeno* OR AB phenomeno*	11	phenomeno*.mp.

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
12	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 norm*).kf,tw.	S12	(MH "Narratives+")	12	narratives/ or narrative analysis/
13	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 communication*).kf,tw.	S13	TI narrative* OR AB narrative*	13	narrative*.mp.
14	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (behavior* or behaviour*)).kf,tw.	S14	TI biograph* OR AB biograph*	14	biograph*.mp.
15	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 (peer adj1 support*)).kf,tw.	S15	(MH "Autobiographies")	15	Autobiography/
16	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 recruitment).kf,tw.	S16	TI Autobiograph* OR AB Autobiograph*	16	Autobiograph*.mp.
17	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 (built adj environment)).kf,tw.	S17	TI documentar* OR AB documentar*	17	documentar*.mp.
18	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 resource*).kf,tw.	S18	TI "qualitative synthes*" OR AB "qualitative synthes*"	18	qualitative synthes*.mp.
19	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 (reward* or recognition)).kf,tw.	S19	TI "active feedback" OR AB "active feedback"	19	active feedback.mp.
20	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 (shared adj3 (mission or vision))).kf,tw.	S20	TI conversation* OR AB conversation*	20	conversation*.mp.
21	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 communit*).kf,tw.	S21	TI discourse* OR AB discourse*	21	discourse*.mp.
22	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (education or training)).kf,tw.	S22	TI thematic OR AB thematic	22	thematic.mp.

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
23	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 relationship*).kf,tw.	S23	TI "qualitative data" OR AB "qualitative data"	23	qualitative data.mp.
24	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj3 tradition*).kf,tw.	S24	TI "key informant*" OR AB "key informant*"	24	key informant*.mp.
25	Culture/ and Workplace/	S25	(MH "Focus Groups")	25	Focus Group/
26	*organizational culture/	S26	TI "focus group*" OR AB "focus group*"	26	focus group*.mp.
27	*Organizational Policy/	S27	TI "case report*" OR AB "case report*"	27	case report*.mp.
28	*leadership/	S28	(MH "Interviews+")	28	Interview/ or interview*.mp.
29	((worker* or employe* or manager* or staff or workforce) adj1 (wellbeing or well-being or wellness or health* or outcome* or behav*)).kf,tw.	S29	TI (interview*) OR AB (interview*)	29	Q-methodology.mp.
30	((worker* or employe* or manager* or staff or workforce) adj1 (job adj satisfaction)).kf,tw.	S30	(MH "Observational Methods+")	30	Observation Methods/
31	((worker* or employe* or manager* or staff or workforce) adj1 (involvement or empowerment)).kf,tw.	S31	TI observer* OR AB observer*	31	observer*.mp.
32	((worker* or employe* or manager* or staff or workforce) adj1 (reward* or recognition)).kf,tw.	S32	TI "visual data" OR AB "visual data"	32	visual data.mp.
33	((worker* or employe* or manager* or staff or workforce) adj1 (push back or pushback or (peer support or peer-support))).kf,tw.	S33	TI "audio record*" OR AB "audio record*"	33	(audio adj record*).mp.
34	((worker* or employe* or manager* or staff or workforce) adj1 engagement).kf,tw.	S34	(MH "Anthropology+")	34	Anthropology/
35	Health Promotion/ and Employment/	S35	TI experience* OR AB experience*	35	experience*.mp.
36	job satisfaction/ and (health or wellbeing or well-being).kf,tw.	S36	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35	36	or/1-35

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
37	*Workplace/px [Psychology]	S37	(MH "Clinical Trials+")	37	exp clinical trial/
38	(health-related adj1 outcomes).kf,tw.	S38	(MH "Study Design+")	38	exp Research Design/
39	(psychological adj wellbeing).kf,tw.	S39	(MH "Random Assignment")	39	Placebo/
40	*Healthy People Programs/	S40	(MH "Double-Blind Studies+")	40	Cross-Over Studies/
41	*Occupational Health/	S41	(MH "Single-Blind Studies")	41	or/37-40
42	or/1-28	S42	(MH "Placebos")	42	(clinic* adj25 trial*).mp.
43	or/29-41	S43	(MH "Crossover Design")	43	random*.mp.
44	Case Reports/	S44	S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43	44	control*.mp.
45	Organizational Case Studies/	S45	TI (clinic* N25 trial*) OR AB (clinic* N25 trial*)	45	(latin adj square).mp.
46	Qualitative Research/	S46	TI random* OR AB random*	46	placebo*.mp.
47	qualitative research*.mp.	S47	TI control* OR AB control*	47	or/42-46
48	qualitative stud*.mp.	S48	TI (latin N1 square) OR AB (latin N1 square)	48	comparative stud*.mp.
49	action research.mp.	S49	TI placebo* OR AB placebo*	49	validation stud*.mp.
50	Community-Based Participatory Research/	S50	S45 OR S46 OR S47 OR S48 OR S49	50	evaluation stud*.mp.
51	participatory research.mp.	S51	(MH "Comparative Studies")	51	(followup stud* or follow-up stud*).mp.
52	case stud*.mp.	S52	TI "comparative stud*" OR AB "comparative stud*"	52	(realist adj (design or evaluation* or review* or research or approach)).mp.
53	ethno*.mp.	S53	(MH "Validation Studies")	53	Prospective Studies/
54	grounded theory.mp.	S54	TI "validation stud*" OR AB "validation stud*"	54	cross over.mp.
55	phenomeno*.mp.	S55	(MH "Evaluation Research+")	55	crossover.mp.
56	Narration/	S56	TI "evaluation stud*" OR AB "evaluation stud*"	56	prospective*.mp.
57	narrative*.mp.	S57	(MH "Prospective Studies+")	57	volunteer*.mp.
58	biograph*.mp.	S58	TI (followup or follow-up) OR AB (followup or follow-up)	58	or/48-57
59	Autobiography/	S59	(MH "Prospective Studies+")	59	singl*.mp.
60	Autobiograph*.mp.	S60	(MH "Crossover Design")	60	doubl*.mp.
61	documentar*.mp.	S61	TI ("cross over" or crossover) OR AB ("cross over" or crossover)	61	trebl*.mp.
62	qualitative synthes*.mp.	S62	TI (prospective* N2 (stud* or design)) OR AB (prospective* N2 (stud* or design))	62	tripl*.mp.

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
63	active feedback.mp.	S63	TI volunteer* OR AB volunteer*	63	or/59-62
64	conversation*.mp.	S64	S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63	64	mask*.mp.
65	discourse*.mp.	S65	TI singl* OR AB singl*	65	blind*.mp.
66	thematic.mp.	S66	TI doubl* OR AB doubl*	66	64 or 65
67	qualitative data.mp.	S67	TI trebl* OR AB trebl*	67	63 and 66
68	key informant*.mp.	S68	TI tripl* OR AB tripl*	68	41 or 47 or 58 or 67
69	Focus Groups/	S69	S65 OR S66 OR S67 OR S68	69	surveys/ or questionnaires/ or longitudinal studies/ or prospective studies/
70	focus group*.mp.	S70	TI mask* OR AB mask*	70	(survey* or questionnaire*).mp.
71	case report*.mp.	S71	TI blind* OR AB blind*	71	Mortality/
72	Interview/ or interview*.mp.	S72	S70 OR S71	72	cohort*.mp.
73	Q-methodology.mp.	S73	S69 AND S72	73	case-control.mp.
74	Observation/	S74	S44 OR S50 OR S64 OR S73	74	cross sectional.mp.
75	observer*.mp.	S75	(MH "Prospective Studies+")	75	longitudinal.mp.
76	visual data.mp.	S76	(MH "Case Control Studies+")	76	risk.tw.
77	(audio adj record*).mp.	S77	(MH "Cross Sectional Studies")	77	incidence.mp.
78	Anthropology, Cultural/	S78	(MH "Surveys")	78	prevalence.mp.
79	experience*.mp.	S79	(MH "Incidence")	79	mortality.tw.
80	or/44-79	S80	(MH "Prevalence")	80	case series.mp.
81	exp clinical trial/	S81	(MH "Mortality")	81	time series.mp.
82	exp Research Design/	S82	TI cohort* OR AB cohort*	82	before-and-after.mp.
83	random allocation/	S83	TI case-control OR AB case-control	83	prognos*.mp.
84	double-blind method/	S84	TI "cross sectional" OR AB "cross sectional"	84	predict*.mp.
85	Single-Blind Method/	S85	TI (health W1 survey*) OR AB (health W1 survey*)	85	predict*.tw.
86	Placebos/	S86	TI (longitudinal or risk or incidence or prevalence or mortality) OR AB (longitudinal or risk or incidence or prevalence or mortality)	86	or/69-85
87	Cross-Over Studies/	S87	TI "case series" OR AB "case series"	87	(mixed adj5 method*).mp.
88	or/81-87	S88	TI "time series" OR AB "time series"	88	multimethod*.mp.

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
89	(clinic* adj25 trial*).mp.	S89	TI ("before and after") OR AB ("before and after")	89	(multiple adj5 method*).mp.
90	random*.mp.	S90	TI prognos* OR AB prognos*	90	or/87-89
91	control*.mp.	S91	TI prognos* OR AB prognos*	91	qualitative.mp.
92	(latin adj square).mp.	S92	S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86 OR S87 OR S88 OR S89 OR S90 OR S91	92	Qualitative Research/
93	placebo*.mp.	S93	TI ((realist W2 (design or evaluation* or review* or research or approach)).) OR TI ((realist W2 (design or evaluation* or review* or research or approach)).)	93	91 or 92
94	or/89-93	S94	TI (mixed W5 method*) OR AB (mixed W5 method*)	94	quantitative.mp.
95	Comparative Study/	S95	TI multimethod* OR AB multimethod*	95	93 and 94
96	comparative stud*.mp.	S96	TI (multiple W5 method*) OR AB (multiple W5 method*)	96	90 or 95
97	Validation Studies/	S97	S93 OR S94 OR S95 OR S96	97	36 or 86 or 90 or 96
98	validation stud*.mp.	S98	TI qualitative OR AB qualitative	98	97 not (letter or comment or editorial or newspaper article).pt.
99	evaluation studies/	S99	(MH "Qualitative Studies")	99	98 not (exp animals/ not humans.sh.)
100	evaluation stud*.mp.	S100	TI quantitative OR AB quantitative	100	*culture change/
101	Follow-Up Studies/	S101	S98 OR S99 OR S97	101	*workplace intervention/
102	(followup stud* or follow-up stud*).mp.	S102	S100 AND S101	102	*workplace intervention/
103	(realist adj (design or evaluation* or review* or research or approach)).mp.	S103	S36 OR S74 OR S92 OR S102	103	(cultur* adj1 health).ti,ab.
104	Prospective Studies/	S104	TI (culture N1 health) OR AB (culture N1 health)	104	(cultur* adj3 health adj3 (wellbeing or well-being or wellness)).ti,ab.
105	Cross-Over Studies/	S105	TI (((workplace or worksite or Organi#ation*) N3 ethos N25 health)) OR AB (((workplace or worksite or Organi#ation*) N3 ethos N25 health))	105	(organi#ation adj1 cultur* adj3 (health or wellbeing or well-being or wellness)).ti,ab.
106	cross over.mp.	S106	S104 OR S115 OR S116 OR S117 OR S118 OR S119 OR S120 OR S121 OR S122 OR S105	106	(support* adj1 (leader* or cultur* or Organi#ation* or environment*)).ti,ab.

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
107	crossover.mp.	S107	(MH "Organizational Culture+")	107	(psychosocial adj work* adj environment).ti,ab.
108	prospective*.mp.	S108	(MH "Organizational Policies")	108	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (strateg* or polic*)).ti,ab.
109	volunteer*.mp.	S109	TI (((worker* or employee* or manager* or staff or workforce) N1 (wellbeing or well-being or health or outcome* or behav*))) OR AB (((worker* or employee* or manager* or staff or workforce) N1 (wellbeing or well-being or health or outcome* or behav*)))	109	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (climate* or morale)).ti,ab.
110	or/95-109	S110	TI (((Employee* or worker*) N5 (job N1 satisfaction))) OR AB (((Employee* or worker*) N5 (job N1 satisfaction)))	110	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 ethos).ti,ab.
111	singl*.mp.	S111	(MH "Work Environment")	111	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 leader*).ti,ab.
112	doubl*.mp.	S112	TI (((wellbeing or well-being) N25 outcome*)) OR AB (((wellbeing or well-being) N25 outcome*))	112	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 value*).ti,ab.
113	trebl*.mp.	S113	TI (((health$ or wellbeing or well-being) N1 (strateg$ or program$ or intervention$))) OR AB (((health$ or wellbeing or well-being) N1 (strateg$ or program$ or intervention$)))	113	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 norm*).ti,ab.
114	tripl*.mp.	S114	S107 OR S108 OR S109 OR S110 OR S111 OR S112 OR S113	114	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 communication*).ti,ab.
115	or/111-114	S115	TI (culture N3 health N3 wellbeing) OR AB (culture N3 health N3 wellbeing)	115	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (behavior* or behaviour*)).ti,ab.
116	mask*.mp.	S116	TI (culture N3 health N3 well-being) OR AB (culture N3 health N3 well-being)	116	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (peer adj1 support*)).ti,ab.

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
117	blind*.mp.	S117	TI (support* N3 culture*) OR AB (support* N3 culture*)	117	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 recruitment).ti,ab.
118	116 or 117	S118	TI (workplace N1 culture N1 health) OR AB (workplace N1 culture N1 health)	118	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (built adj environment)).ti,ab.
119	115 and 118	S119	TI (((worksite or workplace) N1 (strateg* or polic*))) OR AB (((worksite or workplace) N1 (strateg* or polic*)))	119	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 resource*).ti,ab.
120	88 or 94 or 110 or 119	S120	TI ((Healt* N1 (workplace or worksite) N1 culture)) OR AB ((Healt* N1 (workplace or worksite) N1 culture))	120	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (reward* or recognition)).ti,ab.
121	Cohort Studies/	S121	TI (((workplace or worksite or Organi#ation*) N3 culture* N25 health)) OR AB (((workplace or worksite or Organi#ation*) N3 culture* N25 health))	121	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (shared adj3 (mission or vision))).ti,ab.
122	Case-Control Studies/	S122	TI (((workplace or worksite or Organi#ation*) N3 climate* N25 health)) OR AB (((workplace or worksite or Organi#ation*) N3 climate* N25 health))	122	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 communit*).ti,ab.
123	Cross-Sectional Studies/	S123	S115 OR S116 OR S117 OR S118 OR S119 OR S120 OR S121 OR S122	123	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 (education or training)).ti,ab.
124	"Surveys and Questionnaires"/ or Longitudinal Studies/	S124	S103 AND S114 AND S123	124	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 relationship*).ti,ab.
125	(survey* or questionnaire*).mp.	S125	Limiters - Exclude MEDLINE records	125	((workplace or work-place or work-site or worksite or Organi#ation* or institution*) adj1 tradition*).ti,ab.
126	Risk/			126	*organizational climate/
127	Incidence/			127	*transformational leadership/
128	Prevalence/			128	("quality of work life"/ or job satisfaction/ or working conditions/) and personnel/

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
129	Mortality/			129	((worker* or employe* or manager* or staff or workforce) adj1 (wellbeing or well-being or wellness or health* or behav*)).ti,ab.
130	cohort*.mp.			130	((worker* or employe* or manager* or staff or workforce) adj1 (job adj satisfaction)).ti,ab.
131	case-control.mp.			131	((worker* or employe* or manager* or staff or workforce) adj1 (involvement or empowerment)).ti,ab.
132	cross sectional.mp.			132	((worker* or employe* or manager* or staff or workforce) adj1 (reward* or recognition)).ti,ab.
133	longitudinal.mp.			133	((worker* or employe* or manager* or staff or workforce) adj1 (push back or pushback or (peer support or peer-support))).ti,ab.
134	risk.tw.			134	((worker* or employe* or manager* or staff or workforce) adj1 engagement).ti,ab.
135	incidence.mp.			135	(health-related adj1 outcomes).ti,ab.
136	prevalence.mp.			136	(psychological adj wellbeing).ti,ab.
137	mortality.tw.			137	(psychological adj wellbeing).ti,ab.
138	case series.mp.			138	or/100-127
139	time series.mp.			139	or/128-137
140	before-and-after.mp.			140	99 and 138 and 139
141	prognos*.mp.			141	("quality of work life"/ or *job satisfaction/ or *working conditions/) and (wellbeing or well-being or wellness or health* or outcome* or behav*).ti,ab.
142	predict*.mp.			142	limit 140 to all journals
143	predict*.tw.				
144	or/121-143				
145	(mixed adj5 method*).mp.				
146	multimethod*.mp.				
147	(multiple adj5 method*).mp.				
148	or/145-147				

Medline (OVID)		CINAHL Complete (EBSCO)		PsycINFO (OVID)	
149	qualitative.mp.				
150	Qualitative Research/				
151	quantitative.mp.				
152	149 or 150				
153	151 and 152				
154	148 or 153				
155	80 or 120 or 144 or 154				
156	155 not (letter or comment or editorial or newspaper article).pt.				
157	156 not (exp animals/ not humans.sh.)				
158	157 and 42 and 43				
159					

Appendix D **Systematic reviews for forward citation searching and reference chasing**

Brand SL, Thompson Coon J, Fleming LE, et al. Whole-system approaches to improving the health and wellbeing of healthcare workers: A systematic review. *PLoS One*. 2017;12(12):e0188418.
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Appendix E **Included studies**

Sixty studies, reported across 60 articles, met the inclusion criteria. One study was reported across two articles (Bourbonnais et al., 2006 and Bourbonnais et al., 2011) and one article reported findings from two separate studies (von Thiele Schwarz et al., 2017) both of which met the inclusion criteria.

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Appendix F **Excluded studies**

221 unique studies excluded from 229 references

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Appendix G **Critical appraisal – section breakdown**

Table 60 Selection bias criteria

Study ID	Are the individuals selected to participate in the study likely to be representative of the target population?	What percentage of selected individuals agreed to participate?	Section rating	Comments
Adler 2009	Very likely	60 – 79%	Moderate	
Anderzén 2005	Very likely	60 – 79%	Moderate	
Arundell 2018	Very likely	Less than 60%	Weak	
Aust 2010	Can't tell	80 – 100%	Moderate	Unclear number of employees in hospital
Barrech 2017	Very likely	Can't Tell	Weak	Number of participants given (189 males) but total invited or percentage accepted not explicitly stated
Bourbonnais 2011	Very likely	60 – 79%	Moderate	
Brakenridge 2016	Can't tell	60 – 79%	Weak	Data wasn't given on recruitment
Castro 2012	Very likely	80 – 100%	strong	
Crain 2019	Very likely	Can't Tell	Weak	No response rate information
Delanoeije 2020	Can't tell	Can't Tell	Weak	No response rate information, not clear how departments were chosen or if they're representative
Dishman 2009	Very likely	Less than 60%	Weak	
Elo 2008	Can't tell	Can't Tell	Weak	
Elo 2014	Can't tell	Can't Tell	Weak	

Study ID	Are the individuals selected to participate in the study likely to be representative of the target population?	What percentage of selected individuals agreed to participate?	Section rating	Comments
Fikretoglu 2019	Very likely	80 – 100%	Strong	
Gilbert-Ouimet 2011	Very likely	80 – 100%	Strong	
Gregory 2018	Very likely	60 – 79%	Moderate	
Hamar 2015	Can't tell	Can't Tell	Weak	
Hammer 2011	Can't tell	60 – 79%	Weak	
Havermans 2018	Very likely	60 – 79%	Moderate	
Hendriksen 2016	Very likely	80 – 100%	Strong	
Holman 2016	Very likely	80 – 100%	Strong	
Hosboyar 2018	Can't tell	Can't Tell	Weak	No response rate information, not clear how departments were chosen or if they're representative
Jarman 2015	Very likely	Less than 60%	Weak	
Jeon 2015	Very likely	Can't Tell	Weak	Overall population number not provided; however, only 97 (7.5%) staff were identified as having completed the surveys at all 3 times.

Study ID	Are the individuals selected to participate in the study likely to be representative of the target population?	What percentage of selected individuals agreed to participate?	Section rating	Comments
Kawakami 2005	Very likely	80 – 100%	strong	
Kim 2014	Very likely	80 – 100%	Strong	
Kobayashi 2008	Very likely	80 – 100%	Strong	
Kukkuraine n 2012	Very likely	Less than 60%	Weak	
Lavoie-Tremblay 2005	Very likely	80 – 100%	strong	
Li 2017	Very likely	60 – 79%	Moderate	
Lundmark 2017	Very likely	Less than 60%	Weak	
Mache 2020	Very likely	80 – 100%	Strong	
Mattila 2006	Very likely	80 – 100%	Strong	
Michishita 2017	Somewhat likely	Less than 60%	Weak	
Moen 2011	Can't tell	80 – 100%	Weak	80% response rate at baseline. Selection of departments to take part unclear in this paper
Moen 2013a	Very likely	Can't Tell	Weak	Level of participation not described
Moen 2013b	Very likely	80 – 100%	Strong	
Moen 2016	Very likely	60 – 79%	Moderate	

Study ID	Are the individuals selected to participate in the study likely to be representative of the target population?	What percentage of selected individuals agreed to participate?	Section rating	Comments
Mulligan 2012	Very likely	Can't Tell	Moderate	Participant number randomised was not given in Figure 1
Neves 2018	Very likely	60 – 79%	Moderate	
Nielsen 2009	Can't tell	80 – 100%	Moderate	Can't tell what the overall sample is
Nielsen 2012	Very likely	80 – 100%	Strong	
Odle-Dusseau 2016	Very likely	Less than 60%	Weak	
Olson 2015	Very likely	60 – 79%	Moderate	
Pryce 2006	Can't tell	Can't Tell	Weak	
Seidel 2017	Very likely	Less than 60%	Weak	
Sjögren 2006	Very likely	60 – 79%	Moderate	
Steele Gray 2015	Very likely	Can't Tell	Moderate	
Tafvelin 2019a	Somewhat likely	60 – 79%	Moderate	73% response from leaders, 90% of team members invited took part but were referred by their leaders
Tafvelin 2019b	Very likely	60 – 79%	Moderate	
Vaag 2013	Very likely	Less than 60%	Weak	

Study ID	Are the individuals selected to participate in the study likely to be representative of the target population?	What percentage of selected individuals agreed to participate?	Section rating	Comments
Van Bogaert 2014	Very likely	60 – 79%	Moderate	
van Scheppingen 2014	Very likely	Less than 60%	Weak	
von Thiele Schwarz 2015	Very likely	80 – 100%	Strong	
von Thiele Schwarz 2017 – Case 1	Can't tell	Can't Tell	Weak	No info provided at baseline, only at follow up
von Thiele Schwarz 2017 – Case 2	Very likely	60 – 79%	Moderate	
Wieneke 2016	Somewhat likely	Less than 60%	Weak	
Wieneke 2019	Very likely	60 – 79%	Moderate	
Williams 2007	Very likely	80 – 100%	Strong	
Wyman 2020	Very likely	80 – 100%	strong	

Table 61 Study design criteria

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
Adler 2009	Randomized controlled trial	Yes	No	Not applicable	Strong	
Anderzén 2005	Controlled clinical trial	No	Not applicable	Not applicable	Strong	
Arundell 2018	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Aust 2010	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Barrech 2017	Cohort analytic (two group pre + post)	Yes	No	Not applicable	Moderate	
Bourbonnais 2011	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Brakenridge 2016	Randomized controlled trial	Yes	No	Not applicable	Strong	
Castro 2012	Randomized controlled trial	Yes	No	Not applicable	Strong	
Crain 2019	Randomized controlled trial	Yes	No	Not applicable	Strong	

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
Delanoeije 2020	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Dishman 2009	Randomized controlled trial	Yes	Yes	Yes	Strong	
Elo 2008	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Elo 2014	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Fikretoglu 2019	Randomized controlled trial	Yes	Yes	Yes	Strong	
Gilbert-ouimet 2011	Other	No	Not applicable	Not applicable	Weak	Repeated cross-sectional surveys, pre/post intervention. Inconsistent sample
Gregory 2018	Other	No	Not applicable	Not applicable	Weak	
Hamar 2015	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	Employee outcomes analysed using pre/post study, comparison group from

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
						general population doesn't feature in central analysis of intervention
Hammer 2011	Controlled clinical trial	Yes	No	Not applicable	Strong	Controlled trial where method of randomisation is not described
Havermans 2018	Controlled clinical trial	Yes	No	Not applicable	Strong	Controlled trial where method of randomisation is not described
Hendriksen 2016	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Holman 2016	Cohort analytic (two group pre + post)	Yes	No	Not applicable	Moderate	A clustered quasi-experimental research design was used, with teams rather than individuals
Hosboyar 2018	Other	No	Not applicable	Not applicable	Weak	

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
Jarman 2015	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	Analysis was performed on cohort involved in both timepoints
Jeon 2015	Randomized controlled trial	Yes	Yes	Yes	Strong	
Kawakami 2005	Randomized controlled trial	Yes	No	Not applicable	Strong	
Kim 2014	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Kobayashi 2008	Controlled clinical trial	No	Not applicable	Not applicable	Strong	
Kukkurainen 2012	Other	No	Not applicable	Not applicable	Weak	Repeated cross-sectional surveys, pre/post organisational change. Inconsistent sample
Lavoie-tremblay 2005	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Li 2017	Other	No	Not applicable	Not applicable	Weak	Long-term follow-up from a cross over

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
						RCT paired with a control arm
Lundmark 2017	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Mache 2020	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Mattila 2006	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Michishita 2017	Randomized controlled trial	Yes	No	Not applicable	Strong	
Moen 2011	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Moen 2013a	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Moen 2013b	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Moen 2016	Randomized controlled trial	Yes	Yes	Yes	Strong	

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
Mulligan 2012	Randomized controlled trial	Yes	Yes	Yes	Strong	
Neves 2018	Case-control	No	Not applicable	Not applicable	Moderate	
Nielsen 2009	Other	No	Not applicable	Not applicable	Weak	New members of staff included in the second survey
Nielsen 2012	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Odle-dusseau 2016	Other	No	Not applicable	Not applicable	Weak	Repeated cross-sectional design with inconsistent samples across timepoints
Olson 2015	Randomized controlled trial	Yes	Yes	Yes	Strong	
Pryce 2006	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Seidel 2017	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	
Sjögren 2006	Randomized controlled trial	Yes	Yes	Yes	Strong	

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
Steele gray 2015	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	Pre/post quasi experimental design - hospital redevelopment with one group
Tafvelin 2019a	Cohort (one group pre + post (before and after))	No	Not applicable	Not applicable	Moderate	Part of an overall RCT but this design analyses one arm of trial only
Tafvelin 2019b	Cohort (one group pre + post (before and after))	Not applicable	Not applicable	Not applicable	Moderate	
Vaag 2013	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Van bogaert 2014	Other	No	Not applicable	Not applicable	Weak	
Van Scheppingen 2014	Cohort analytic (two group pre + post)	No	Not applicable	Not applicable	Moderate	
Von Thiele Schwarz 2015	Controlled clinical trial	Yes	No	Not applicable	Strong	Demoted to CCT upon realising that randomisation occurred
Von Thiele Schwarz	Controlled clinical trial	Yes	No	Not applicable	Strong	Demoted to CCT as method

Study ID	Indicate the study design	Randomized	If Yes, was the method of randomization described?	If Yes, was the method appropriate?	Section rating	Comments
2017 – Case 1						of randomisation not described
Von Thiele Schwarz 2017 – Case 2	Controlled clinical trial	Yes	No	Not applicable	Strong	Demoted to CCT as method of randomisation not described
Wieneke 2016	Case-control	No	Not applicable	Not applicable	Moderate	
Wieneke 2019	Other	Not applicable	Not applicable	Not applicable	Weak	One off survey - biennial all staff survey
Williams 2007	Randomized controlled trial	Yes	No	Not applicable	Strong	
Wyman 2020	Randomized controlled trial	Yes	No	Not applicable	Strong	

Table 62 Study confounders criteria

Study ID	Were there important differences between groups prior to the intervention?	If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. Stratification, matching) or analysis)?	Section rating	Comments
Adler 2009	No	Not applicable	Strong	
Anderzén 2005	Yes	Can't Tell	Weak	Analysis controlled for age, gender and severity of pain
Arundell 2018	Yes	80 – 100%	Strong	
Aust 2010	Yes	80 – 100%	Strong	
Barrech 2017	Yes	80 – 100%	Strong	
Bourbonnais 2011	No	Not applicable	Strong	
Brakenridge 2016	Yes	80 – 100%	Strong	
Castro 2012	Yes	60 – 79%	Moderate	Adjusted for combat exposure but not rank
Crain 2019	Can't tell	Can't Tell	Weak	
Delanoeije 2020	Yes	80 – 100%	Strong	
Dishman 2009	Can't tell	Can't Tell	Weak	
Elo 2008	Not applicable	Not applicable	Not applicable	
Elo 2014	Yes	80 – 100%	Strong	
Fikretoglu 2019	No	Not applicable	Strong	
Gilbert-ouimet 2011	Yes	80 – 100%	Strong	
Gregory 2018	No	Not applicable	Strong	
Hamar 2015	No	Not applicable	Strong	Same group
Hammer 2011	No	Not applicable	Strong	No differences of demographic

Study ID	Were there important differences between groups prior to the intervention?	If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. Stratification, matching) or analysis)?	Section rating	Comments
				variables at baseline
Havermans 2018	No	Not applicable	Strong	No differences at baseline
Hendriksen 2016	Not applicable	Not applicable	Not applicable	Same group
Holman 2016	No	Not applicable	Strong	No confounders discussed as significant
Hosboyar 2018	Can't tell	Can't Tell	Weak	No investigation of demographics
Jarman 2015	Yes	80 – 100%	Strong	
Jeon 2015	Yes	80 – 100%	Strong	
Kawakami 2005	Yes	Can't Tell	Weak	
Kim 2014	Not applicable	Not applicable	Not applicable	One group, before and after
Kobayashi 2008	Yes	80 – 100%	Strong	
Kukkurainen 2012	Can't tell	Can't Tell	Weak	Did not describe any significant differences - but no detail provided
Lavoie-tremblay 2005	Not applicable	Not applicable	Not applicable	
Li 2017	No	Not applicable	Strong	No significant differences in table 1, but also adjusted results provided
Lundmark 2017	Not applicable	Not applicable	Strong	Same group

Study ID	Were there important differences between groups prior to the intervention?	If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. Stratification, matching) or analysis)?	Section rating	Comments
Mache 2020	Not applicable	Not applicable	Not applicable	One group, confounders don't apply
Mattila 2006	Yes	80 – 100%	Strong	
Michishita 2017	No	Not applicable	Strong	No significant differences in table 1
Moen 2011	Yes	80 – 100%	Strong	
Moen 2013a	Yes	80 – 100%	Strong	
Moen 2013b	Yes	80 – 100%	Strong	
Moen 2016	Yes	80 – 100%	Strong	
Mulligan 2012	Yes	Less than 60%	Weak	The study arms differed at baseline on gender, engagement type, service, and rank but not in terms of their mental health
Neves 2018	Yes	Can’t Tell	Weak	Didn't control for time with the same supervisor
Nielsen 2009	Can’t tell	Can’t Tell	Weak	No adjustments made
Nielsen 2012	Yes	80 – 100%	Strong	
Odle-dusseau 2016	Can’t tell	Can’t tell	Weak	Not explored
Olson 2015	Yes	Can’t Tell	Weak	
Pryce 2006	Can’t tell	Can’t Tell	Weak	Not explored

Study ID	Were there important differences between groups prior to the intervention?	If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. Stratification, matching) or analysis)?	Section rating	Comments
Seidel 2017	Not applicable	Not applicable	Not applicable	Same group
Sjögren 2006	Can't tell	Can't Tell	Weak	
Steele gray 2015	No	Not applicable	Strong	Data collected but no mention of adjusted/controlled
Tafvelin 2019a	Not applicable	Not applicable	Not applicable	One group only
Tafvelin 2019b	No	Not applicable	Strong	
Vaag 2013	Yes	80 – 100%	Strong	
Van bogaert 2014	Can't tell	Can't tell	Weak	Not explored
Van Scheppingen 2014	Yes	80 – 100%	Strong	
Von Thiele Schwarz 2015	No	Not applicable	Strong	Did describe baseline differences, but they weren't significant
Von Thiele Schwarz 2017 – Case 1	Yes	Can't Tell	Weak	Group 2 older and had longer tenure, doesn't seem to be accounted for in analysis
Von Thiele Schwarz 2017 – Case 2	No	Not applicable	Strong	Not examined specifically
Wieneke 2016	Can't tell	Can't Tell	Weak	
Wieneke 2019	Yes	Less than 60%	Weak	Major differences in groups don't

Study ID	Were there important differences between groups prior to the intervention?	If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. Stratification, matching) or analysis)?	Section rating	Comments
				appear to be adjusted for
Williams 2007	No	Not applicable	Strong	There were no statistically significant associations between the intervention and control groups in demographic and background characteristics
Wyman 2020	No	Not applicable	Strong	There were no differences between the Wingman-Connect and Stress Management groups on any variable

Table 63 Blinding criteria

Study ID	Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?	Were the study participants aware of the research question?	Section rating	Comments
Adler 2009	Can't tell	Can't tell	Weak	
Anderzén 2005	Can't tell	Yes	Weak	Not discussed
Arundell 2018	Can't tell	Can't tell	Weak	
Aust 2010	Can't tell	Can't tell	Weak	
Barrech 2017	Can't tell	Can't tell	Weak	Blinding is not described
Bourbonnais 2011	Can't tell	Can't tell	Weak	
Brakenridge 2016	Yes	Yes	Weak	
Castro 2012	Yes	Yes	Weak	
Crain 2019	Can't tell	Can't tell	Weak	
Delanoeije 2020	Can't tell	Yes	Weak	
Dishman 2009	Can't tell	Can't tell	Weak	
Elo 2008	No	Can't tell	Moderate	Blinding is not described
Elo 2014	Can't tell	Can't tell	Weak	
Fikretoglu 2019	No	No	Strong	Triple-blinded trial; Three quarters (75.73%) of the Control recruits reported "not at all" or "very little" communication," with Intervention group.
Gilbert-ouimet 2011	Can't tell	Can't tell	Weak	
Gregory 2018	Can't tell	Can't tell	Weak	
Hamar 2015	Yes	Can't tell	Weak	
Hammer 2011	Can't tell	Yes	Weak	

Study ID	Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?	Were the study participants aware of the research question?	Section rating	Comments
Havermans 2018	Can't tell	Yes	Weak	
Hendriksen 2016	Yes	Yes	Weak	
Holman 2016	Yes	Yes	Weak	
Hosboyar 2018	Can't tell	Yes	Weak	-
Jarman 2015	Yes	Yes	Weak	
Jeon 2015	No	No	Strong	Double blind design
Kawakami 2005	Can't tell	Can't tell	Weak	
Kim 2014	Can't tell	Yes	Weak	
Kobayashi 2008	Can't tell	Yes	Weak	All workers in the study were told of the study aim (p.457) but no mention of blinding
Kukkurainen 2012	Yes	Yes	Weak	
Lavoie-tremblay 2005	Can't tell	Can't tell	Weak	
Li 2017	Can't tell	Can't tell	Weak	
Lundmark 2017	Yes	Yes	Weak	Survey
Mache 2020	Can't tell	Yes	Weak	
Mattila 2006	Can't tell	Can't tell	Weak	No mention of blinding
Michishita 2017	Can't tell	Can't tell	Weak	
Moen 2011	Can't tell	Can't tell	Weak	Not specified if employees were informed of purpose of data gathering
Moen 2013a	Can't tell	Yes	Weak	
Moen 2013b	Can't tell	Yes	Weak	
Moen 2016	Can't tell	Yes	Weak	

Study ID	Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?	Were the study participants aware of the research question?	Section rating	Comments
Mulligan 2012	Yes	Can't tell	Weak	
Neves 2018	Can't tell	Yes	Weak	
Nielsen 2009	Can't tell	Can't tell	Weak	
Nielsen 2012	Can't tell	Yes	Weak	
Odle-dusseau 2016	Can't tell	Can't tell	Weak	
Olson 2015	No	Can't tell	Moderate	
Pryce 2006	Can't tell	Yes	Weak	
Seidel 2017	Yes	Yes	Weak	
Sjögren 2006	No	Can't tell	Moderate	
Steele gray 2015	Yes	Yes	Weak	
Tafvelin 2019a	Can't tell	Can't tell	Weak	
Tafvelin 2019b	Yes	Yes	Weak	
Vaag 2013	Can't tell	Can't tell	Weak	Not specified if employees were informed of purpose of data gathering
Van bogaert 2014	Can't tell	Can't tell	Weak	
Van Scheppingen 2014	Can't tell	Can't tell	Weak	Not specified if employees were informed of purpose of data gathering
Von Thiele Schwarz 2015	Can't tell	Yes	Weak	
Von Thiele Schwarz 2017 – Case 1	Can't tell	Can't tell	Weak	Not specified if employees were informed of purpose of data gathering

Study ID	Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?	Were the study participants aware of the research question?	Section rating	Comments
Von Thiele Schwarz 2017 – Case 2	Can't tell	Can't tell	Weak	Not specified if employees were informed of purpose of data gathering
Wieneke 2016	Yes	Yes	Weak	Survey
Wieneke 2019	Can't tell	Can't tell	Weak	No data on blinding
Williams 2007	Can't tell	Can't tell	Weak	
Wyman 2020	Can't tell	Yes	Weak	

Table 64 Data collection methods criteria

Study ID	Were data collection tools shown to be valid?	Were data collection tools shown to be reliable?	Section rating	Comments
Adler 2009	Yes	Yes	Strong	
Anderzén 2005	Yes	Yes	Strong	
Arundell 2018	Yes	Yes	Strong	
Aust 2010	Yes	Yes	Strong	
Barrech 2017	Yes	Yes	Strong	
Bourbonnais 2011	Yes	Yes	Strong	
Brakenridge 2016	Yes	Yes	Strong	Had to research outside article for measure/tools reliability/validity - not explicitly stated
Castro 2012	Yes	Yes	Strong	
Crain 2019	Yes	Yes	Strong	
Delanoeije 2020	Yes	Yes	Strong	
Dishman 2009	Yes	Yes	Strong	
Elo 2008	Yes	Yes	Strong	
Elo 2014	Yes	Yes	Strong	
Fikretoglu 2019	Yes	Yes	Strong	All measures are well-established in literature and internal consistencies are calculated for this study
Gilbert-ouimet 2011	Yes	Yes	Strong	
Gregory 2018	Yes	Yes	Strong	Measures used scales published and found to be valid and reliable

Study ID	Were data collection tools shown to be valid?	Were data collection tools shown to be reliable?	Section rating	Comments
Hamar 2015	Yes	Yes	Strong	
Hammer 2011	Yes	Yes	Strong	
Havermans 2018	Yes	Yes	Strong	
Hendriksen 2016	Can't tell	Yes	Weak	Energy & Performance Scan, Management Vitality Perception Scan - scales shown to have good internal consistency but validity is not discussed
Holman 2016	Yes	Yes	Strong	
Hosboyar 2018	Yes	Yes	Strong	
Jarman 2015	Yes	Yes	Strong	
Jeon 2015	Yes	Yes	Strong	
Kawakami 2005	Yes	Yes	Strong	
Kim 2014	Yes	Yes	Strong	
Kobayashi 2008	Yes	Yes	Strong	Measures used tools found to be valid and reliable
Kukkurainen 2012	Can't tell	Can't tell	Weak	Only some measures analysed for reliability, not all. Several bespoke instruments
Lavoie-tremblay 2005	Yes	Yes	Strong	
Li 2017	Yes	Yes	Strong	
Lundmark 2017	Yes	Yes	Strong	Single items and short scales from

Study ID	Were data collection tools shown to be valid?	Were data collection tools shown to be reliable?	Section rating	Comments
				well-validated questionnaires were used
Mache 2020	Yes	Yes	Strong	
Mattila 2006	Yes	Yes	Strong	
Michishita 2017	Yes	Yes	Strong	
Moen 2011	Yes	Yes	Strong	
Moen 2013a	Yes	Yes	Strong	Satisfactory Cronbach's alphas, established tools
Moen 2013b	Yes	Yes	Strong	
Moen 2016	Yes	Yes	Strong	
Mulligan 2012	Yes	Yes	Strong	
Neves 2018	Yes	Yes	Strong	For the primary outcome POS
Nielsen 2009	Yes	Yes	Strong	
Nielsen 2012	Yes	Yes	Strong	Measures used tools published and found to be valid and reliable
Odle-dusseau 2016	Yes	Yes	Strong	
Olson 2015	Yes	Yes	Strong	
Pryce 2006	Yes	Yes	Strong	
Seidel 2017	Can’t tell	Can’t tell	Weak	
Sjögren 2006	Yes	Yes	Strong	Measures used cited scales
Steele gray 2015	Yes	Yes	Strong	Measures used scales published and found to be valid and reliable
Tafvelin 2019a	Yes	No	Moderate	Single items make it difficult to establish reliability

Study ID	Were data collection tools shown to be valid?	Were data collection tools shown to be reliable?	Section rating	Comments
				and may also raise concerns about construct validity p.27
Tafvelin 2019b	Can't tell	Can't tell	Weak	
Vaag 2013	Yes	Yes	Strong	
Van bogaert 2014	Yes	Yes	Strong	
Van Scheppingen 2014	Yes	Yes	Strong	
Von Thiele Schwarz 2015	Yes	Yes	Strong	
Von Thiele Schwarz 2017 – Case 1	Yes	Yes	Strong	Measures used scales published and found to be valid and reliable
Von Thiele Schwarz 2017 – Case 2	Yes	Yes	Strong	
Wieneke 2016	Yes	Yes	Strong	Mostly validated tools used, some bespoke items also included
Wieneke 2019	Yes	Yes	Strong	
Williams 2007	Yes	Yes	Strong	
Wyman 2020	Yes	Yes	Strong	

Table 65 Withdrawals and drop-outs criteria

Study ID	Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?	Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).	Section rating	Comments
Adler 2009	Yes	Less than 60%	Weak	
Anderzén 2005	Yes	60 – 79%	Moderate	Numbers of dropouts were provided but final sample calculation made by HRB
Arundell 2018	Yes	Less than 60%	Weak	59% dropout
Aust 2010	Yes	60 – 79%	Moderate	
Barrech 2017	No	Less than 60%	Weak	Drop out numbers weren't described, but a dropout analysis was mentioned
Bourbonnais 2011	Yes	Less than 60%	Weak	
Brakenridge 2016	Yes	60 – 79%	Moderate	
Castro 2012	Yes	Less than 60%	Weak	
Crain 2019	Yes	60 – 79%	Moderate	No reasons reported and 79% follow up
Delanoeije 2020	No	80 – 100%	Weak	
Dishman 2009	Yes	Less than 60%	Weak	
Elo 2008	No	80 – 100%	Weak	
Elo 2014	No	Can’t Tell	Weak	
Fikretoglu 2019	Yes	60 – 79%	Moderate	The overall attrition rate for T1–T2 was 19.60% and the overall

Study ID	Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?	Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).	Section rating	Comments
				attrition rate for T1–T3 was 30.66%.
Gilbert-ouimet 2011	Not applicable	Not applicable	Not applicable	Repeated cross-sectional design - not able to ascertain dropouts
Gregory 2018	Not applicable	Not applicable	Not applicable	
Hamar 2015	Can't tell	Can't Tell	Weak	Only participants with three timepoints of data included, not clear how large a proportion of the population this represents
Hammer 2011	Yes	60 – 79%	Moderate	
Havermans 2018	Yes	60 – 79%	Moderate	
Hendriksen 2016	Yes	Less than 60%	Weak	
Holman 2016	Yes	Less than 60%	Weak	96 started;62 completed (59.52%)
Hosboyar 2018	No	Can't Tell	Weak	Only overall numbers included in study provided. No invited vs baseline vs completed
Jarman 2015	Not applicable	Not applicable	Not applicable	
Jeon 2015	Yes	Less than 60%	Weak	

Study ID	Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?	Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).	Section rating	Comments
Kawakami 2005	Yes	80 – 100%	Strong	
Kim 2014	Yes	80 – 100%	Strong	
Kobayashi 2008	No	80 – 100%	Strong	Intervention group (92%) and control group (82%)
Kukkurainen 2012	Not applicable	Not applicable	Not applicable	
Lavoie-tremblay 2005	Yes	80 – 100%	Strong	
Li 2017	Yes	Less than 60%	Weak	Long follow-up study
Lundmark 2017	Yes	Less than 60%	Weak	
Mache 2020	No	60 – 79%	Weak	
Mattila 2006	No	80 – 100%	Strong	No dropouts reported at all. 525 incl. IG, CG1, CG2
Michishita 2017	Yes	80 – 100%	Strong	
Moen 2011	No	80 – 100%	Weak	
Moen 2013a	No	80 – 100%	Weak	
Moen 2013b	No	Can't Tell	Weak	
Moen 2016	Yes	80 – 100%	Strong	
Mulligan 2012	Yes	Less than 60%	Weak	56.1% in standard brief group
Neves 2018	Not applicable	Not applicable	Not applicable	
Nielsen 2009	Not applicable	Not applicable	Not applicable	
Nielsen 2012	No	Less than 60%	Weak	
Odle-dusseau 2016	Not applicable	Not applicable	Not applicable	Not applicable when study design was repeated cross sectional survey.

Study ID	Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?	Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).	Section rating	Comments
				Cannot ascertain dropouts.
Olson 2015	Yes	Less than 60%	Weak	240/562 analysed in final sample
Pryce 2006	No	80 – 100%	Weak	
Seidel 2017	Not applicable	Not applicable	Not applicable	Not matched across timepoints
Sjögren 2006	Yes	80 – 100%	Strong	
Steele gray 2015	No	Less than 60%	Weak	
Tafvelin 2019a	Yes	60 – 79%	Moderate	
Tafvelin 2019b	No	Can't Tell	Weak	
Vaag 2013	No	60 – 79%	Weak	66.1% retention at follow-up
Van bogaert 2014	Not applicable	Not applicable	Not applicable	Repeated cross-sectional design
Van Scheppingen 2014	Yes	Less than 60%	Weak	
Von Thiele Schwarz 2015	No	60 – 79%	Weak	
Von Thiele Schwarz 2017 – Case 1	Yes	80 – 100%	Strong	
Von Thiele Schwarz 2017 – Case 2	Yes	60 – 79%	Moderate	
Wieneke 2016	Not applicable	Not applicable	Not applicable	
Wieneke 2019	Not applicable	Not applicable	Not applicable	
Williams 2007	No	Can't Tell	Weak	Data provided on basic training completion but not intervention

Study ID	Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?	Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).	Section rating	Comments
Wyman 2020	Yes	80 – 100%	Strong	

Table 66 Intervention integrity criteria

Study ID	What percentage of participants received the allocated intervention or exposure of interest?	Was the consistency of the intervention measured?	Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?	Comments
Adler 2009	80 – 100%	Yes	No	
Anderzén 2005	80 – 100%	Can't tell	Not applicable	Consistency not mentioned
Arundell 2018	80 – 100%	No	Can't tell	All employees moved to new building under intervention condition
Aust 2010	80 – 100%	No	No	
Barrech 2017	80 – 100%	No	No	
Bourbonnais 2011	80 – 100%	No	No	
Brakenridge 2016	80 – 100%	No	No	
Castro 2012	80 – 100%	No	No	
Crain 2019	Can't Tell	No	No	
Delanoeije 2020	80 – 100%	No	No	
Dishman 2009	80 – 100%	No	No	
Elo 2008	80 – 100%	No	No	
Elo 2014	80 – 100%	No	No	
Fikretoglu 2019	80 – 100%	Yes	No	
Gilbert-ouimet 2011	Can't tell	No	Can't tell	Implementation not discussed
Gregory 2018	80 – 100%	No	No	It wasn't assessed
Hamar 2015	80 – 100%	No	No	
Hammer 2011	80 – 100%	No	No	
Havermans 2018	80 – 100%	Yes	No	Variable for extent of implementation within team

Study ID	What percentage of participants received the allocated intervention or exposure of interest?	Was the consistency of the intervention measured?	Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?	Comments
Hendriksen 2016	80 – 100%	Yes	Can't tell	Variable attendance for different components of the intervention: "participation rates of the kick-off session, the in- and outtake, the vitality training sessions, and the evaluation by phone were very high (95 to 100%). About 30% of the participants received intensive individual coaching and the interactive workshops were attended by 75% (first workshop) and 54% (second workshop) of the participants."
Holman 2016	80 – 100%	No	Yes	All employees briefed on study and control group got initial survey results

Study ID	What percentage of participants received the allocated intervention or exposure of interest?	Was the consistency of the intervention measured?	Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?	Comments
Hosboyar 2018	80 – 100%	No	No	
Jarman 2015	80 – 100%	No	No	
Jeon 2015	80 – 100%	No	No	
Kawakami 2005	80 – 100%	No	Yes	Seven workers in the intervention group were working under a Section chief who was originally assigned to the training Group but did not receive training
Kim 2014	Can't Tell	No	No	
Kobayashi 2008	80 – 100%	Can't tell	Yes	Supervisors in control group may have implemented environment improvement (Limitations, p467)
Kukkurainen 2012	80 – 100%	No	No	
Lavoie-tremblay 2005	80 – 100%	No	No	
Li 2017	80 – 100%	No	No	
Lundmark 2017	80 – 100%	No	No	
Mache 2020	80 – 100%	No	No	
Mattila 2006	80 – 100%	Can't tell	Can't tell	Employees aware of purpose of study
Michishita 2017	80 – 100%	No	No	

Study ID	What percentage of participants received the allocated intervention or exposure of interest?	Was the consistency of the intervention measured?	Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?	Comments
Moen 2011	80 – 100%	No	Can't tell	
Moen 2013a	80 – 100%	No	No	
Moen 2013b	80 – 100%	No	No	
Moen 2016	80 – 100%	Yes	No	
Mulligan 2012	80 – 100%	No	No	
Neves 2018	80 – 100%	No	No	Unclear how knowing other sites are in proximity to downsizing might affect results
Nielsen 2009	80 – 100%	No	No	
Nielsen 2012	80 – 100%	Can't tell	No	
Odle-dusseau 2016	80 – 100%	Yes	No	Employees coded based on whether their supervisor attended the training - training is once-off
Olson 2015	80 – 100%	No	No	
Pryce 2006	80 – 100%	No	No	
Seidel 2017	80 – 100%	No	No	
Sjögren 2006	80 – 100%	No	No	
Steele gray 2015	80 – 100%	No	No	
Tafvelin 2019a	80 – 100%	No	No	
Tafvelin 2019b	80 – 100%	No	No	
Vaag 2013	60 – 79%	No	No	Final sample 69.8% participants
Van bogaert 2014	80 – 100%	No	No	

Study ID	What percentage of participants received the allocated intervention or exposure of interest?	Was the consistency of the intervention measured?	Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?	Comments
Van Scheppingen 2014	80 – 100%	No	No	
Von Thiele Schwarz 2015	80 – 100%	No	No	
Von Thiele Schwarz 2017 – Case 1	80 – 100%	No	No	
Von Thiele Schwarz 2017 – Case 2	80 – 100%	No	No	
Wieneke 2016	80 – 100%	Yes	No	In the intervention arm, then split by participating and not participating
Wieneke 2019	80 – 100%	No	No	
Williams 2007	80 – 100%	No	No	
Wyman 2020	80 – 100%	No	Yes	2 in the intervention group and 3 in the control reassigned to class in alternate condition

Table 67 Analyses criteria

Study ID	Indicate the unit of allocation	Indicate the unit of analysis	Are the statistical methods appropriate for the study design?	Is the analysis performed by intervention allocation status (i.e. Intention to treat) rather than the actual intervention received?	Comments
Adler 2009	Practice/office	Individual	Yes	Yes	
Anderzén 2005	Practice/office	Individual	Yes	No	
Arundell 2018	Organization/institution	Individual	Yes	Yes	
Aust 2010	Practice/office	Individual	Yes	No	
Barrech 2017	Individual	Individual	Yes	Yes	
Bourbonnais 2011	Practice/office	Individual	Yes	No	
Brakenridge 2016	Individual	Individual	Yes	Yes	
Castro 2012	Practice/office	Individual	Yes	Can't tell	
Crain 2019	Individual	Individual	Yes	No	
Delanoeije 2020	Individual	Individual	Yes	No	
Dishman 2009	Practice/office	Individual	Yes	Yes	
Elo 2008	Practice/office	Individual	Yes	No	
Elo 2014	Practice/office	Individual	Yes	No	
Fikretoglu 2019	Practice/office	Individual	Yes	No	
Gilbert-Ouimet 2011	Organization/institution	Individual	Yes	No	
Gregory 2018	Practice/office	Individual	Yes	Yes	
Hamar 2015	Organization/institution	Individual	Yes	No	
Hammer 2011	Practice/office	Individual	Yes	No	
Havermans 2018	Individual	Individual	Yes	Yes	

Study ID	Indicate the unit of allocation	Indicate the unit of analysis	Are the statistical methods appropriate for the study design?	Is the analysis performed by intervention allocation status (i.e. Intention to treat) rather than the actual intervention received?	Comments
Hendriksen 2016	Organization/institution	Individual	Yes	No	
Holman 2016	Individual	Individual	Yes	Can't tell	
Hosboyar 2018	Individual	Individual	Yes	Yes	
Jarman 2015	Organization/institution	Individual	Yes	No	
Jeon 2015	Practice/office	Individual	Yes	Yes	
Kawakami 2005	Practice/office	Individual	Yes	No	Described as an ITT analysis but only includes people who had baseline and follow-up data
Kim 2014	Practice/office	Individual	Yes	No	
Kobayashi 2008	Practice/office	Individual	Yes	Yes	
Kukkurainen 2012	Practice/office	Individual	Yes	No	
Lavoie-Tremblay 2005	Practice/office	Individual	Yes	No	
Li 2017	Practice/office	Individual	Yes	No	
Lundmark 2017	Organization/institution	Individual	Yes	No	
Mache 2020	Practice/office	Individual	Yes	Can't tell	
Mattila 2006	Practice/office	Individual	Yes	No	
Michishita 2017	Practice/office	Individual	Yes	No	
Moen 2011	Individual	Individual	Yes	Can't tell	
Moen 2013a	Individual	Individual	Yes	Can't tell	

Study ID	Indicate the unit of allocation	Indicate the unit of analysis	Are the statistical methods appropriate for the study design?	Is the analysis performed by intervention allocation status (i.e. Intention to treat) rather than the actual intervention received?	Comments
Moen 2013b	Individual	Individual	Yes	No	
Moen 2016	Individual	Individual	Yes	No	
Mulligan 2012	Practice/office	Individual	Yes	Yes	
Neves 2018	Practice/office	Individual	Yes	No	251 analysed only
Nielsen 2009	Practice/office	Individual	Yes	No	
Nielsen 2012	Practice/office	Individual	Yes	No	
Odle-Dusseau 2016	Practice/office	Individual	Yes	No	
Olson 2015	Practice/office	Individual	Yes	No	
Pryce 2006	Individual	Individual	Yes	No	
Seidel 2017	Organization/institution	Individual	Yes	No	
Sjögren 2006	Practice/office	Individual	Yes	No	
Steele Gray 2015	Organization/institution	Individual	Yes	No	
Tafvelin 2019a	Organization/institution	Individual	Yes	No	
Tafvelin 2019b	Practice/office	Individual	Yes	No	
Vaag 2013	Individual	Individual	Yes	No	
Van Bogaert 2014	Individual	Individual	Yes	No	
Van Scheppingen 2014	Individual	Individual	Yes	No	
Von Thiele Schwarz 2015	Individual	Individual	Yes	Yes	

Study ID	Indicate the unit of allocation	Indicate the unit of analysis	Are the statistical methods appropriate for the study design?	Is the analysis performed by intervention allocation status (i.e. Intention to treat) rather than the actual intervention received?	Comments
Von Thiele Schwarz 2017 – Case 1	Practice/office	Individual	Yes	Can't tell	
Von Thiele Schwarz 2017 – Case 2	Practice/office	Individual	Yes	Can't tell	
Wieneke 2016	Practice/office	Individual	Yes	No	
Wieneke 2019	Practice/office	Individual	Yes	No	
Williams 2007	Practice/office	Individual	Yes	Can't tell	
Wyman 2020	Practice/office	Individual	Yes	Yes	