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(Article begins on next page)

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The relationship between union membership and workers' well-being: a systematic review and meta-analysis

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The decreasing trade union membership experienced in most European countries in the past two decades can have negative effects on working conditions. Some of the most important dimensions along which this potential negative effect can be observed are those of workers' health and subjective well-being. A systematic examination of empirical studies on the association between union membership and individual workers' health, and life and job satisfaction can complement previous systematic studies focusing on the association between unionisation levels and average workers' well-being. A systematic review of this literature – featuring both a meta-analysis and a narrative synthesis – indicates: (i) a lack of studies on the topic in the context of European countries; and (ii) the existence of a positive and significant relationship between union membership and individuals' well-being, in both centralised and decentralised systems. Moreover, it emerges that union membership is a protective factor for health outcomes.

Résumé

Zusammenfassung

Keywords

Union membership, mental health, physical health, well-being, life satisfaction, work satisfaction, systematic review, meta-analysis

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Introduction

Since the 1980s, trade union density has declined substantially across OECD countries,[1] going from 30 per cent in 1985 to 17 per cent in 2016 (OECD, 2017). Trade unions' loss of power has affected all OECD countries, albeit unevenly (Nergaard and Stokke, 2007; Waddington et al., 2023). A shrinking manufacturing sector and the implementation of labour market policies favouring precarious and temporary work are among the factors that have weakened trade unions' power and influence (OECD, 2017; Schnabel, 2013).

This decline in union density can have a significant, negative impact on individuals' working and life conditions. In fact, previous academic research has consistently documented the positive impact of unions on workers' economic, psychological and health conditions, education, health care,

[1] Between 1985 and 2015, union density declined across most European countries, including France (2 per cent), Italy (7 per cent) and Germany (17 per cent) (OECD, 2017).

environment and work organisation, and exposure to gender, age-related and ethnic discrimination (Leigh and Chakalov, 2021; Mishel et al., 2015; Bivens et al., 2017; Farber et al., 2021; Jones et al., 2014; Park et al., 2019; Weil, 1991; Booth, 2003; Keune, 2013; OECD, 2019a). This body of research has identified two main mechanisms through which unions can positively affect the health of workers: (i) improvement of material conditions (for example, wage levels) and (ii) improvement of health conditions (both physical and psychological) in the workplace. Thus it has been found, for instance, that union efforts to raise wages and reduce wage inequality and discrimination lead to an increase in pensions, paid sick leave, paid family leave, paid and non-paid vacation leave, and employment-provided health insurance coverage, which in turn lead to an improvement in workers' health and subjective well-being (Aronsson and Gustafsson, 2005; Asfaw et al., 2017; Card et al., 2012; Darity, 2003; Herd et al., 2008; Krieger, 2014; O'Brien, 2003; Leigh et al., 2019; Rossin, 2011). Considering the second mechanism, better working conditions contribute to workers' health and subjective well-being by decreasing physical strain, injuries, and sickness, thus affecting stress and job-related psychological demands. Similarly, increased on-the-job safety training, as well as the effects that unions bring about in the domain of the environment and work organisation are likely to improve workers' health and well-being (Colligan and Cohen, 2004; Cylus et al., 2015; Krause and Lund, 2004; Levy et al., 2018; Li and Singleton, 2019; Stuckler and Basu, 2013; Tregaskis and Nandi, 2023; Wagstaff and Lie, 2011).

Despite the wealth of literature on unions' positive effects on workers' health, it is worth noting that most previous studies focus on the association between measures of unionisation and union density, and workers' average well-being

and health status (Choi et al., 2021; Dollard and Neser, 2013; Economou and Theodossiou, 2015; Fenn and Ashby, 2004; Flavin et al., 2010; Kim and Cho, 2016; Nichols et al., 2007; Reynolds and Buffel, 2020; Zoorob, 2018). To be sure, the benefits that high unionisation levels bring to both members and non-members are significant and represent an explicit goal of collective bargaining. At the same time, it is important from both the academic and the policy standpoints to assess whether there are also specific benefits from individual membership, in terms of members' health and subjective well-being. In fact, direct benefits – which often take the form of legal representation, filing workplace complaints and handling disputes with management, offering training programmes and career development resources – may represent an important incentive for union membership. These incentives are clearly very relevant in the context of decentralised bargaining systems, but we can expect that also in centralised bargaining systems individual's benefits represent an incentive to join unions (Barth et al., 2025; Peetz, 1998; Riley, 1997). Only a few studies, however, focus on the effects of individual union membership on workers' health and well-being. This systematic review will examine this latter strand of literature, conducting both a meta-analysis and a narrative synthesis of the available quantitative empirical evidence on how being part of a union can directly contribute to workers' health and well-being. It thus also assesses the extent to which decreasing union density can affect workers' individual health and well-being.

Review questions and objectives

This systematic review seeks to address and systematise existing knowledge about the association between individual union membership and worker's

health and subjective well-being. Thus, we will try to answer the following questions: (i) is there evidence that union membership brings direct benefits to individual workers in terms of their health status and/or subjective well-being?; and (ii) if such evidence exists, what is the strength of this association according to existing empirical studies?

Answering these questions is important for several reasons. First, this will help to consolidate and generalise the findings reported in an array of studies; second, a systematic review will also help in identifying the main gaps in the academic literature on the topic, paving the way for future research strands, also in relation to the institutional contexts for which empirical evidence is available. Finally, from a more substantive point of view, although union density has significant direct and indirect spillover effects on non-members – especially in the context of collective bargaining – assessing the existence and extent of the association between individual union membership and workers' health and well-being will make it possible to estimate more comprehensively the potential risks to individuals' health connected with decreasing union density.

From an operational standpoint the main question driving our systematic review was formulated using the PICO (Population, Intervention, Comparison and Outcome) approach:[2]

> Is union membership associated with improved physical health, mental health and general levels of well-being, including job and life satisfaction, in unionised workers in comparison with non-unionised workers?

[2] PICO is a framework used to develop literature search strategies in clinical or health-care related studies, as well as in broader disciplines (Higgins and Cochrane Collaboration, 2020a)

An important caveat here is that the effects of union membership may vary depending on the institutional context and thus the practical meaning of membership. For example, while in centralised bargaining systems union membership is often connected with empowering the unions in obtaining better conditions via collective, sector-level bargaining, in the context of decentralised systems the benefits of membership are often to be found at the individual and company level (Ibsen and Keune, 2018). This distinction, which is absent from the few studies on the topic, represents an important lens when interpreting the results reported below.

Analytic approach and methods[3]

Search

The search methods followed the formulation of the question according to the PICO approach, as illustrated in Table 1:

[Table 1 about here]

Designing the search was an iterative process that involved reviewing and refining several search strings and trialling different drafts in databases. A wide range of outcomes were included in the string to focus the search. By contrast, more general terms were included to be able to capture a broader

[3] In order to increase transparency in the reporting of results, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were followed (Page et al., 2021).

spectrum of studies. For each database, the search strings were inputted for title, abstract and keywords.

The finalised search string was applied in five electronic sources, which include all the major databases in the health and social science domains: (i) Web of Science; (ii) Scopus; (iii) EBSCO; (iv) ProQuest; and (v) PubMed (including Medline).

Relevant studies from the bibliographies of the selected articles and literature from relevant international organisations were also screened.

Selection

Study selection involved three distinct phases. First, all the results were merged in one collection and duplicates were removed. Second, articles were screened based on their titles and abstracts, and reasons for exclusion were recorded. Finally, the full text of the remaining studies was screened based on the inclusion and exclusion criteria that were determined before the search and are reported in Table 2. To explore the association between union membership and individual worker's health and subjective well-being, we decided to include studies that focused specifically on the unionised working population, that is, workers who are union members, regardless of whether the bargaining system of the country is centralised or decentralised. That is for two reasons: first, we want to investigate whether, in general, the literature suggests that the 'status' of unionised worker brings about any direct benefits to individual workers in terms of their health status and/or subjective well-being. In fact, this can be an important incentive for individuals to join a union. Second, the paucity of studies on the topic does not make it possible to focus

only on studies conducted in homogenous institutional contexts. Where 'unionisation' was part of the analysis as a mediating or moderating factor, studies were included only if the models presented clear estimates of the moderating/mediating effects.

[Table 2 about here]

Critical appraisal of included studies

For the purposes of this review, studies were appraised using the ROBINS-E tool for non-randomised studies of exposures (Higgins et al., 2023). The tool seemed appropriate to the aims of this systematic review because it is tailor made for non-randomised studies.

The ROBINS-E tool (as well as the ROBINS-I tool for non-randomised studies of interventions) is considered a reliable tool for appraising the risk of bias in studies. The tool is based on a three-stage process: preliminary specification of key confounders (for example, democratic characteristics and job-related characteristics), assessment of risk of bias of the included studies in various specific domains (for example, measure of outcomes, exposure and missing confounders), and an overall rating of risk of bias across all (Sterne et al., 2016).[4] For further details on the appraisal see Appendix A: Critical appraisal of included studies using ROBINS-E.

[4] Despite being widely considered a reliable tool for risk of bias assessment, some concerns have been raised about the use of ROBINS-E; see, for instance, Bero et al. (2018), Chastin et al. (2021), Filippini et al. (2020) and Shields et al. (2021).

Methods

The research question will be answered with a systematic literature review, using two instruments: a meta-analysis and a narrative synthesis. The two instruments will be utilised, alternatively, for two groups of studies. A meta-analysis will be utilised on articles that consider workers' general level of well-being as their outcome. Articles focusing on the relationship between union membership and workers' health, on the other hand, will be analysed using the instrument of narrative synthesis because of their low number and significant heterogeneity in terms of outcome variables.

The meta-analysis adopts a random effects approach as a variety of non-randomised studies are included in the analysis that differ in terms of population, methodology and context. The narrative synthesis will offer a comprehensive account of the research on the relationship between union membership and workers' health outcomes. The studies included in the narrative synthesis are synthesised by summarising their main themes and findings in a narrative format.

Sensitivity analyses

A range of sensitivity analyses were conducted to assess the robustness and reliability of the results of the meta-analysis: first, by ensuring a rigorous assessment of the methodological assumptions underpinning the analysis, including the appraisal of studies, undertaken with a conservative approach to judging the risk of bias; second, by implementing both random and fixed effects in the meta-analysis to check how that variation influences the

conclusions of the meta-analysis; third, by examining the level and sources of heterogeneity; and finally by assessing the risk of publication bias.

Results

Search results

The search strategy yielded a total of 374 articles. The PRISMA flow diagram (Figure 1) summarises the identification and screening process, which led to the inclusion of 12 articles in the systematic review.

[Figure 1 about here]

Characteristics of included studies

All the 12 studies included in the review are academic journal articles, four published between 2018 and 2023. The studies focused on two main umbrella outcomes, measured by several proxies: (i) well-being: measured with job satisfaction (3 articles) and life satisfaction (4 articles)[5]; (ii) health: measured with non-fatal injuries (2 articles), self-rated assessment (3 articles) and severity of mental illness (2 articles).

It is worth noting that the majority of the studies included examine countries in which the bargaining system is predominantly decentralised (United States, United Kingdom, South Korea), and thus we may expect that individual and

[5] Well-being is a complex construct to measure, but several studies have suggested a connection between job satisfaction, life satisfaction and general individual well-being (see, for instance, Bowling et al., 2010; Unanue et al., 2017). For this reason, in the present article we consider both life and job satisfaction as proxy measures of workers' well-being.

company-level benefits of union membership are more salient and tangible. Only a minority of studies report on countries with centralised (or mixed) bargaining systems, where the importance and pervasiveness of collective and sectorial contracts may underplay the relevance of the direct individual benefits derived from union membership (one from South Africa and one from Europe, although with multiple estimates). This is already an important finding of our review in itself: there is a significant gap in academic research with regard to the analysis of the health and well-being effects of individual union membership in the context of European labour markets and societies. Even if the existence of a strongly centralised bargaining system may put into the background considerations about individual benefits of membership, these are likely to be an important element in workers' decisions to become a member or not (Barth et al., 2025; Peetz, 2023; Riley, 1997).

The heterogeneity of outcomes, methodologies, approaches and settings of the studies included (reported in Table 3), led to the adoption of a meta-analysis and a narrative synthesis to conduct our review.

[Table 3 about here]

Critical appraisal of included studies

The studies included were appraised using ROBINS-E. The appraisal shows that 58 per cent (or seven out of 12) of the articles included in the systematic review present a high risk of bias, 25 per cent (or three out of 12) present some concerns (medium risk of bias), while 17 per cent (or two out of 12)

present a low risk of bias (see Appendices for a detailed report on the ROBINS-E appraisal)

Meta-analysis

The studies included in the meta-analysis are those that investigate the relationship between union membership and workers' subjective well-being. These studies present a high degree of heterogeneity in terms of the specific population analysed and the methodology adopted. Therefore, the meta-analysis is executed with random effects to account for the fact that the true effect size may vary due to systematic differences between the studies. The meta-analysis is conducted using inverse variance weighting, which assigns more weight to studies with smaller variances (that is, studies with less spread or uncertainty in their effect size estimates) and smaller weights to studies with larger variances. Statistical transformations were made to ensure the comparability of the studies (for further details see Appendix B: Statistical transformations for meta-analysis). The results of the meta-analysis are expressed in the random effects forest plot reported in Figure 2.

[Figure 2 about here]

Figure 2 shows that Green and Heywood (2015) and Heywood et al. (2002) found a negative correlation between union membership and well-being. In other words, union members have lower levels of well-being in comparison with non-union members. All the other studies found a positive correlation,

with union members having higher levels of well-being in comparison with non-union members, although Lee (2022) did not find a statistically significant association. Overall, the combined data suggest a statistically significant positive effect for union members, who have higher levels of well-being than non-union members (0.15, 95% CI = 0.04 to 0.26, p-value < 0.001). As already discussed, a large part of the studies included in this systematic review examine countries with decentralised bargaining systems. Nevertheless, it is interesting to note that all the results based on contexts with a centralised bargaining system (that is, Blanchflower et al., 2022, ESS1 and ESS2; Smit et al., 2016) indicate a significant positive effect of union membership on worker's subjective well-being. Despite the low number of observations, therefore, it seems fair to argue that even in the context of labour relations systems based on collective bargaining, the evidence points consistently in the direction of a positive effect of individual union membership.

It is worth noting, that the model presents a very high degree of heterogeneity, with an overall level expressed by I^2 = 100% and heterogeneity among individual studies expressed by Q(df = 8) = 445778.9069 and statistically significant at a p-value < 0.0001. Although high heterogeneity was expected, as this is a systematic review of non-randomised studies (Higgins and Cochrane Collaboration, 2020), such high heterogeneity means that there is no common effect size that can adequately explain the results observed across all the studies.

Sensitivity analyses

In order to ensure the robustness of the analysis, a range of sensitivity analyses were undertaken. First, a fixed-effects meta-analysis was conducted to assess whether a different statistical specification impacts the result of the meta-analysis. As shown in the forest plot in Figure 3, the results of a fixed-effects meta-analysis do not differ substantially from those of the random-effects meta-analysis, although the combined effect is larger.

[Figure 3 about here]

Second, because re-expressing variables might introduce a risk of bias, the meta-analysis was repeated excluding the studies that present probit coefficients re-expressed in approximate SMD. The forest plot in Figure 4 presents the results of the random effects meta-analysis excluding Charman and Owen (2013) and Lee (2022).

[Figure 4 about here]

It can be seen that the precision of the model has not changed substantially. Overall, the combined data suggest a statistically significant positive effect for union members, who have higher levels of well-being in relation to non-union members (0.18, 95% CI = 0.06 to 0.30, p-value < 0.001). Overall heterogeneity is still at 100% with Q (df = 6) = 442941.8952, significant at a p-value < 0.0001.

Finally, a third sensitivity analysis consists of assessing publication bias, using a funnel plot. The funnel plot (Figure 5) is not symmetrical, with studies

scattered in a random pattern and outside the confidence interval. This indicates a potential for publication bias, but the result could also be due to the high level of heterogeneity characterising this group of studies.

[Figure 5 about here]

Narrative synthesis

Five of the retrieved articles focusing on the association between union membership and workers' physical and mental health outcomes (see Table 2) are analysed using narrative synthesis. These articles are characterised by highly heterogeneous outcomes of interest, population characteristics and methods. This makes them more suitable for a narrative synthesis than for a meta-analysis. Narrative synthesis focuses on identifying the most important themes emerging across the articles, and on providing a synthesis of the current literature on the relationship between union membership and health outcomes. All of the studies included in this analysis refer to either the United States or the United Kingdom and thus institutional contexts characterised by decentralised bargaining.

The studies included in the narrative synthesis draw different conclusions regarding the relationship between union membership and health outcomes. While Eisenberg-Guyot et al. (2020) found a positive non-significant association between union membership and self-rated health and moderate mental illness, Donado (2015) and Gillen et al. (2002) found that union membership is significantly associated with an increase in reported non-fatal occupational injuries. Reynolds and Brady (2012) reported a positive and

significant effect of union membership on self-rated health, while Wels (2020) discussed positive and significant associations with mental health and spillover effects to non-unionised workers.

Drawing on the mechanisms presented in the articles to explain these associations, it is possible to isolate three main ways in which union membership can influence members' health outcomes.

(i) Unions provide better jobs. Unions can provide workers with better material and working conditions, including higher wages and pensions, health insurance, paid sick leave, reductions in overtime and other benefits. Better working conditions, such as shorter hours, can also affect physical and mental health by creating less dangerous workplaces and lowering stress levels. Access to health-care insurance and other benefits such as paid sick leave can help workers to access adequate health care, reduce strain and encourage prevention.

(ii) Unions improve health and safety standards. Unions provide workers with bargaining power to achieve better health and safety standards. This includes providing personal protective equipment, raising health and safety inspections and enforcing safety regulations. This can lower the risk of occupational injuries and work-related stress. Moreover, unions play a pivotal role in encouraging workers to report injuries, which helps to identify and address safety hazards.

(iii) Unions raise awareness and knowledge. Unions provide training to workers on safety procedures and injury prevention and increase workers' knowledge of rights and participation in dangerous work. Moreover, unions monitor employers' compliance with health and safety regulations to ensure that they are meeting their obligations, which can

help prevent injuries and a dangerous workplace. Unions also represent workers in safety disputes with employers to ensure that workers' concerns are heard and that they are treated fairly.

In addition, three contextual factors emerge from the studies that moderate the impact that unions can have on workers' health:

(a) Unions do not affect all members equally. Union membership does not produce the same results for everybody. While being particularly beneficial for men, people with lower levels of education and lower wages, it does not impact women, ethnic minorities and higher educated individuals. This is probably because while the marginal health benefits brought about by unions are much higher for less advantaged workers, women and minorities tend to be under-represented or excluded in unions and therefore do not benefit as much. Nonetheless, it is important to highlight that findings from subgroup analyses are not consistent across articles, for instance while Eisenberg-Guyot et al. (2020) assess ethnicity/race, Reynolds and Brady (2012) only consider gender, education and wages. However, both articles find that pockets of union members receive fewer benefits to their health than others, which they explain with the exclusionary nature of some unions in the United States. Donado (2015) was the only study to find that union membership increases reporting of non-fatal injuries for all analysed sub-groups.
(b) Unions can affect both members and non-members. A positive spillover effect for non-unionised workers in highly unionised workplaces is reported by Wels (2020). This indicates that unions' activities to improve job quality and health and safety standards have universal scope with the

potential to improve the health conditions of the entire workforce, although not homogeneously.

(c) Unions' effects are linked to their power. Unions are able to exert stronger effects on workers' health where they hold power and influence (Eisenberg-Guyot et al., 2020). In other words, higher union density, stronger membership and presence can increase unions' bargaining power and influence, leading to stronger effects on both members and non-members' health.

Confidence in the evidence (GRADE)

An assessment performed using the GRADE framework suggested a moderate level of confidence in the findings of both the meta-analysis and the narrative synthesis. This is because the studies included in both analyses present some serious limitations, as emerged during the appraisal. The findings of the meta-analysis are also likely to be affected by publication bias. Further details on the assessment of confidence can be found in Appendix C: Confidence in the Evidence (GRADE).

Discussion and conclusion

The falling union density experienced in most European countries in the past two decades can have significant negative effects on workers' working and living conditions. One of the most important areas that can be affected by decreasing unionisation is that of workers' health and subjective well-being. Much previous literature has (consistently) documented the existence of a positive relation between the degree of unionisation and workers' health

status and well-being. To the best of our knowledge, however, there is relatively little research and no systematic analyses of the potential effects of individual membership and the (health and well-being related) benefits to union members. Addressing this gap is important from both a scientific and a policy point of view: on the one hand it is important to complement existing studies on the benefits of unions by adopting also a micro-level, individualised approach; second, direct benefits from membership represent an important additional factor incentivising individual workers to become members.

To begin assessing the existence and relevance of such a risk, we conducted a systematic review to answer the following questions. (i) Is there consistent evidence indicating that union membership brings about direct benefits to individual workers in terms of their health status and/or subjective well-being? (ii) If such evidence exists, what is the strength of this association, according to existing empirical studies?

The meta-analysis suggests a statistically significant positive effect for union members, who have higher levels of well-being than those recorded for non-union members (0.15, 95% CI = 0.04 to 0.26, p-value < 0.001). This result applied to both studies with decentralised and mixed or centralised bargaining systems. It is worth noting that, despite the extensive search conducted for this systematic review, there was only a single article reporting on the relationship between union membership and well-being in Europe. This highlights a gap in the literature for the European context. This gap is also present in the narrative synthesis of the relationship between union membership and health, where no study is available in Europe.

The result of the meta-analysis, however, is caveated by the high level of overall heterogeneity, both between and within studies. This heterogeneity is due mainly to the significant differences between the studies along several dimensions: that is, they measure the relationship between union membership and well-being using different outcomes and data sets, across different populations and with different methodologies.

Given the high levels of overall heterogeneity, it is not possible to draw a firm conclusion on the size or direction of the relationship between union membership and life satisfaction from this meta-analysis. However, it is interesting to note that five out of the seven studies included in the meta-analysis do find that union members report a higher level of subjective well-being than non-members. As for what concerns the two articles that report a negative relationship between union membership and well-being, it should be considered that they may be capturing the reverse causality of the relationship, as more dissatisfied workers could be more likely to form or join unions (Garcia-Serrano, 2009).

The narrative synthesis identified three main mechanisms that explain the positive association between union membership and workers' health outcomes. Union membership affects workers' health by (i) providing better jobs (in terms of material and working conditions), (ii) improving health and safety and (iii) raising awareness among workers. The outcomes of these mechanisms are mediated by three contextual considerations. First, members are not affected equally. The most vulnerable workers (individuals with lower levels of education and wage) experience a higher marginal positive improvement in their physical and mental health status when part of a union. Second, non-members can also be affected via spillover effects,

because unions' empowerment of workers has a universal scope that affects all workers, regardless of their membership status. Finally, the strength of the effect is proportional to unions' power. These are particularly relevant findings if we consider that in recent decades unions have lost power and influence (OECD, 2017).

An underlying general mechanism underpinning all three specific mechanisms emerging from the narrative synthesis, and which ultimately explains how unions affect workers' health, can be defined as the *empowerment mechanism*: unions positively affect workers' health by empowering workers to improve their working and material conditions, and health and safety standards. Unions' efforts to empower workers affect both their physical and mental health, with a cumulative effect on overall health. The empowerment of workers via union activity ultimately explains the effect that union membership, and union density, can have on members' health, as well as that of non-members.

Some limitations on this review should be noted. First, not all relevant studies may have been identified, especially those written in languages other than those that are part of the inclusion criteria. Second, the findings of the meta-analysis on the relationship between union membership and well-being are not conclusive: the very high level of heterogeneity of the included studies was an obstacle to establishing firm findings. Moreover, due to the small number of studies included in the analysis and their heterogeneity, we could not draw conclusions on the impact of country-specific characteristics and different institutional contexts; as a matter of fact, our review clearly indicates the significant gap in this area of research when it comes to the context of

European societies. Finally, the narrative synthesis only included five studies, which limited the breadth of information and comparability of the articles.

Net of these limitations, this systematic review clearly shows that most of the existing empirical research suggests that unions have positive effects on union members' well-being and health outcomes. Most of the studies considered in the meta-analysis found positive and significant associations between union membership and well-being. Similarly, even though the synthesised studies drew different conclusions on the quantitative effects of union membership on health outcomes, they all found positive associations.

An important indication emerging from this review is that quantitative research on the direct effects that unions can have on unionised workers' health outcomes and well-being is not exhaustive, and more research is needed to unravel these effects and the micro-level social mechanisms at play in this association. Considering that unions are gaining momentum, with strikes and industrial action happening in several countries in protest at unsafe working conditions during the COVID-19 pandemic and low and stagnant wages during a cost-of-living crisis, academic research should focus on understanding how unions can improve workers' health and well-being most effectively, as well as how better to capture and quantify such a contribution.

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Appendices

The relationship between union membership and workers' wellbeing: a systematic review and meta-analysis

Appendix A: Critical appraisal of included studies using ROBINS-E.

The studies included were appraised using ROBINS-E, which is a comprehensive tool that presents seven domains of assessment:

1. Domain 1: risk of bias as a result of confounding.
2. Domain 2: risk of bias arising from exposure measurement.
3. Domain 3: risk of bias in selection of participants for the study (or the analysis).
4. Domain 4: risk of bias because of post-exposure interventions.
5. Domain 5: risk of bias as a result of missing data.
6. Domain 6: risk of bias arising from measurement of the outcomes.
7. Domain 7: risk of bias in the selection of the reported results.

All these domains present some specific questions and a final general question assessing the overall risk of bias in that domain. The tool also presents a final overall risk of bias question that asks: 'Is the overall risk of bias sufficiently high, in the context of its likely direction and the magnitude of the estimated exposure effect, to threaten conclusions about whether the exposure has an important effect on the outcome?' The possible answers to the tool's questions are: 'Yes', 'Cannot tell' or 'No'. The tool ends by asking the respondent to rate the overall quality of the appraised study by judging whether it is at 'low risk of bias', 'some concerns' are present, or the study is at 'high risk' or 'very high risk' of bias.

Table A1 presents the result of the appraisal for the 12 included studies: 58% (or seven out of 12) of the articles included in the systematic review present a high risk of bias, 25% (or three out of 12) present some concerns (medium risk of bias), while 17% (or two out of 12) present a low risk of bias.

Table A1. Appraisal.

Domains of assessment	1) Blanchflower et al. (2021)	2) Charman & Owen (2013)	3) Donado (2015)	4) Eisenberg-Guyot et al. (2020)	5) Flavin & Shufeldt (2016)	6) Gillen et al. (2002)	7) Green & Heywood (2015)	8) Heywood et al. (2002)	9) Lee (2022)	10) Reynolds & Brady (2012)	11) Smit et al. (2016)	12) Wels (2020)
Domain 1: Risk of bias as a result of confounding	No	No	No	Yes	No	Cannot tell	No	No	No	No	Yes	No
Domain 2: Risk of bias arising from exposure measurement	No	No	No	Cannot tell	No	No	No	No	No	No	No	Cannot tell
Domain 3: Risk of bias in selection of participants for the study (or the analysis)	No	No	No	No	No	No	No	No	No	No	No	No
Domain 4: Risk of bias because of post-exposure interventions	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell

Domain 5: Risk of bias as a result of missing data	Yes	No	Yes	No	Yes	Yes	Cannot tell	Yes	Cannot tell	No	Yes	Cannot tell
Domain 6: Risk of bias arising from measurement of the outcomes	No	No	No	No	No	No	No	No	No	No	No	No
Domain 7: Risk of bias in selection of the reported results	No	No	No	No	No	No	No	No	No	No	No	No
Overall quality	High risk of bias	Low risk with some concerns	High risk of bias	High risk of bias	High risk of bias	High risk of bias	Some concerns	High risk of bias	Some concerns	Low risk with some concerns	High risk of bias	Some concerns

The appraisal was undertaken taking a conservative approach, and its rationale is as follows:

1. Domain 1: risk of bias as a result of confounding. Risk of bias is considered unlikely if a comprehensive confounding factors list was included in the study, including all the variables used to measure them (for instance, listed in a regression table). In this case a 'No' answer would be applied. If confounding factors were not explicitly mentioned in the study, then risk of bias was considered likely and a 'Yes' answer was applied. Finally, if only a few confounding factors were included in the study, it was deemed not possible to judge the likelihood of risk of bias. In that case the answer would be 'Cannot tell'.

2. Domain 2: risk of bias arising from measurement exposure. Risk of bias is considered unlikely (i.e., answer 'No') if the exposure measurement (unionisation) was collected via large, general surveys that are considered reliable (such as the British Household Panel Survey and the European Social Survey) and if exposure is measured clearly and reflects the inclusion criteria of this systematic review.

3. Domain 3: risk of bias in selection of participants for the study (or the analysis). Risk of bias is unlikely (i.e., answer 'No') if participants are recruited in a large, general survey of the population (such as the British Household Panel Survey and the World Values Survey). When selection bias might be present in the survey used (and identified as a potential limitation by the author), the appraisal answer would be 'Cannot tell'.

4. Domain 4: risk of bias because of post-exposure interventions. Risk of bias is always appraised as 'Cannot tell' because it is not possible to know whether post-exposure interventions have occurred in each context as none of the studies mentions them.

5. Domain 5: risk of bias as a result of missing data. Risk of bias is likely (answer 'Yes') if the treatment of missing data for the purposes of analysis is not mentioned at all (for example, there is no mention of whether the authors carried out a complete case analysis or imputation) and it is not stated clearly what data are missing (on outcome, exposure or confounding variable). If missing data is unlikely because the data set used has a very low level of missingness, but no further information has been given around the missingness of key variables (as is the case for Wels, 2020), then it is not possible to judge the likelihood of risk of bias as a result of missing data and the answer is 'Cannot tell'.

6. Domain 6: risk of bias arising from measurement of the outcomes. Risk of bias is considered unlikely (answer 'No') if the outcome (physical health, mental health, well-being and life satisfaction) is measured clearly, reflective of the inclusion criteria and collected via large, population-level surveys.

7. Domain 7: risk of bias in the selection of the reported results. Risk of bias is considered unlikely (i.e., answer ‘No’) if the selection of reported results is judged to be accurate.

The overall risk of bias is assessed, conservatively, depending on the number of ‘No’, ‘Yes’ and ‘Cannot tell’ answers accumulated during the assessment, as reported in Table 4.

Despite being widely considered a reliable tool for risk of bias assessment, some concerns have been identified regarding the use of ROBINS-E. For example, the tool appears to be incomplete in its assessment of domains of risk of bias (Bero et al., 2018). While it is important to acknowledge the limitations of this tool, as they reflect limitations for the overall quality of this systematic review, this was the most fitting tool to appraise non-randomised studies of exposure, as it is routinely used in systematic reviews of non-randomised studies in the field of health and mental health (Chastin et al., 2021; Filippini et al., 2020; Shields et al., 2021).

Appendix B: Statical transformations for the meta-analysis.

Before the meta-analysis could be undertaken, some statistical transformations were required. These transformations were done in the statistical software R, using the appropriate data extracted by the studies. The first statistical transformation concerned the studies by Blanchflower et al. (2022) and Heywood et al. (2002), which reported t-statistics instead of standard errors. Standard errors are needed for the meta-analysis; therefore, the t-statistics were transformed to standard errors.

Moreover, two studies, Charman and Owen (2013) and Lee (2022), used a probit ordered model. To combine these studies in a single meta-analysis, the probit coefficients were re-expressed in approximate standardised mean differences (SMD). Probit coefficients are typically used in the context of binary outcomes to describe the impact of the predictor variable on the probability of an event occurring, while SMD is used to describe the difference in means between two groups in continuous outcome data. Assuming that the continuous variable underlying the binary outcome (which the probit attempts to model) follows a normal distribution for both union members and non-union members, and assuming that the variability of the outcome is the same across the two groups, we consider the cumulative probabilities estimated by the probit model as the proportion of individuals in each group who experience the outcome. These proportions can be used as estimated means for the two groups. Then, the formula below can be used to calculate the SMD:

$$SMD = \frac{Mean1 - Mean2}{Pooled\ standard\ deviation}$$

Where:

- SMD is the standardised mean difference.
- Mean 1 is the estimated mean for group 1 (union members).
- Mean 2 is the estimated mean for group 2 (non-union members).
- The pooled standard deviation can be calculated based on the variances of standard errors associated with the estimated means for each group.

While re-expressing variables in order to combine them in a single meta-analysis is methodologically accepted, it is important to note that it might introduce a risk of bias to the final meta-analysis estimate, as this process often leads to an oversimplification of assumptions for comparability ((Higgins and Cochrane Collaboration, 2020). In this case, the probit coefficients re-expressed as SMD are only an approximation. For this reason, in the sensitivity analyses the meta-analysis has been repeated excluding the studies that present probit coefficients re-expressed in approximate SMD.

Appendix C: Confidence in the evidence (GRADE).

The GRADE framework (Table C1) was used to assess the quality of evidence and show the confidence in the findings from this mixed-method review. The GRADE framework was used to evaluate the confidence in the findings for both the meta-analysis and the narrative synthesis. The assessment suggested a moderate level of confidence in the findings of both the meta-analysis and the narrative synthesis. This is because the studies included in both analyses present some serious limitations, as emerged during the appraisal (Table 4). The finding of the meta-analysis is also likely to be affected by publication bias.

Table C1. GRADE framework.

No. of studies	Finding	Study limitations (risk of bias)	Consistency of results between studies	Directness of evidence (how closely it measures the outcome	Imprecision (results were not statistically significant)	Publication bias	Quality

				of interest)			
Life satisfaction 7 studies (9 estimates)	0.15, 95% CI = 0.04 to 0.26, p-value < 0.001	Serious	No important inconsistency	Direct	No important imprecision	Likely	Moderate
Physical and mental health outcomes: 5	Unions have a positive impact on workers' health	Serious	No important inconsistency	Direct	No important imprecision	Unlikely	Moderate

Figure 1. PRISMA Diagram.

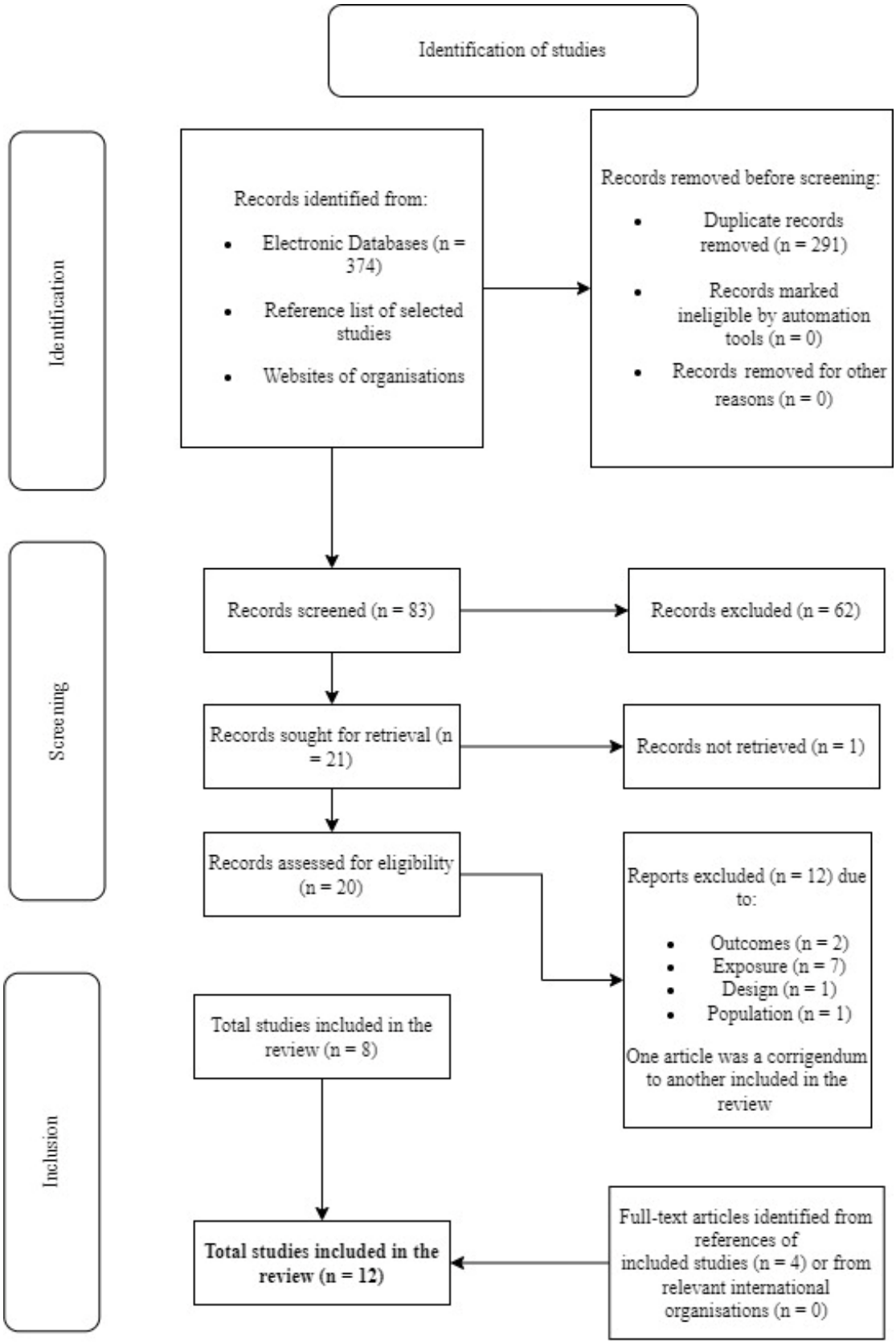
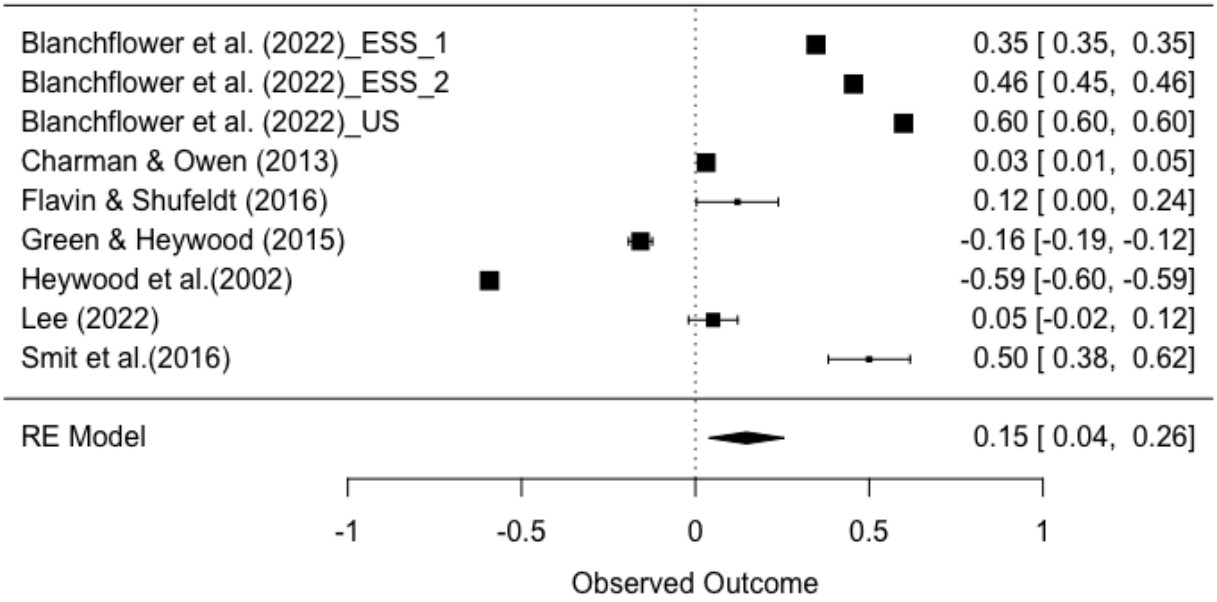


Figure 2. Forest plot of random-effects meta-analysis.



Note: Blanchflower et al. (2022) presented 3 different estimates of the relationship between union membership and well-being, which were included in the meta-analysis as separate estimates. The first one is from the 2002–2008 ESS data, the second is from the 2010–2018 ESS data and the third is from the 2009–2017 Gallup US Daily tracker data in the USA.

Figure 3. Forest plot of fixed-effects meta-analysis.

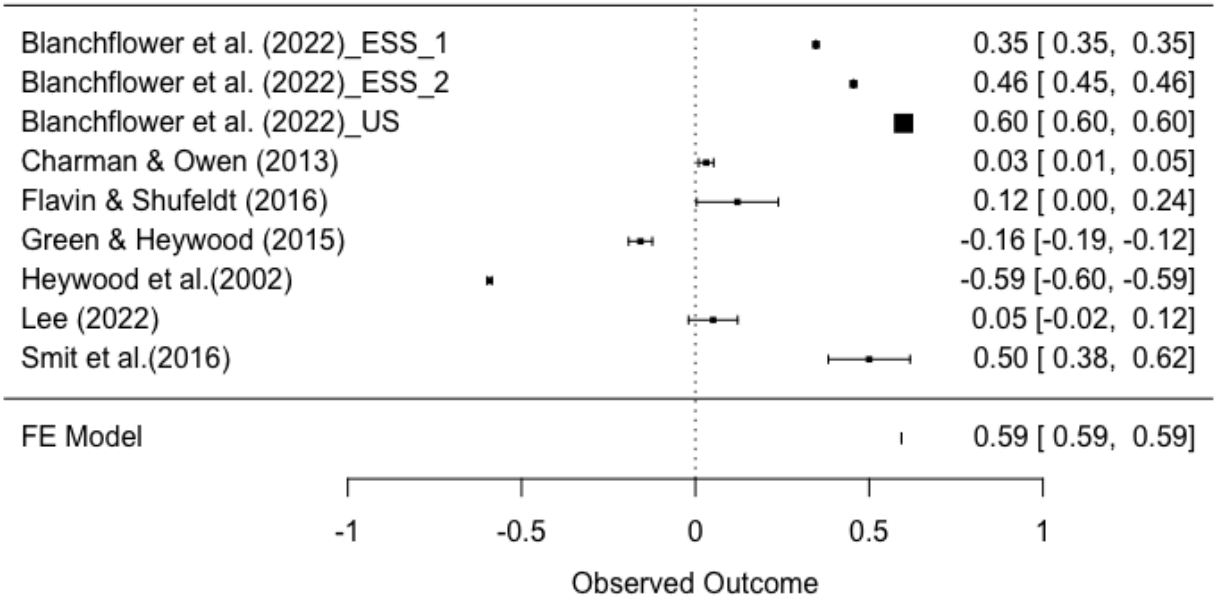


Figure 4. Forest plot of random effects meta-analysis excluding Charman and Owen (2013) and Lee (2022).

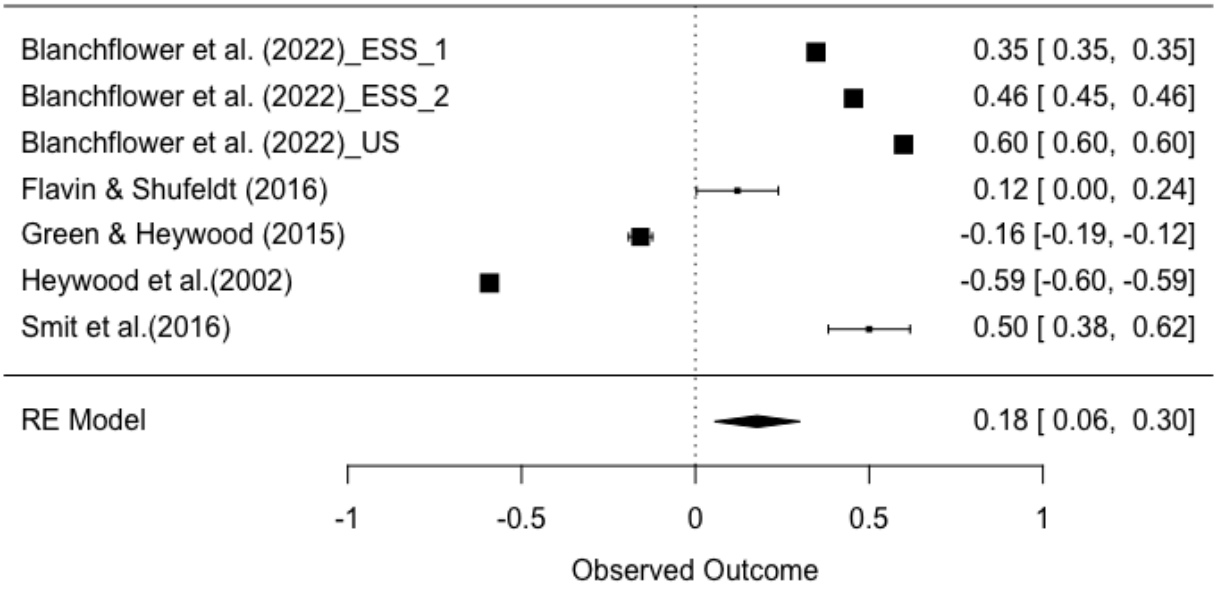
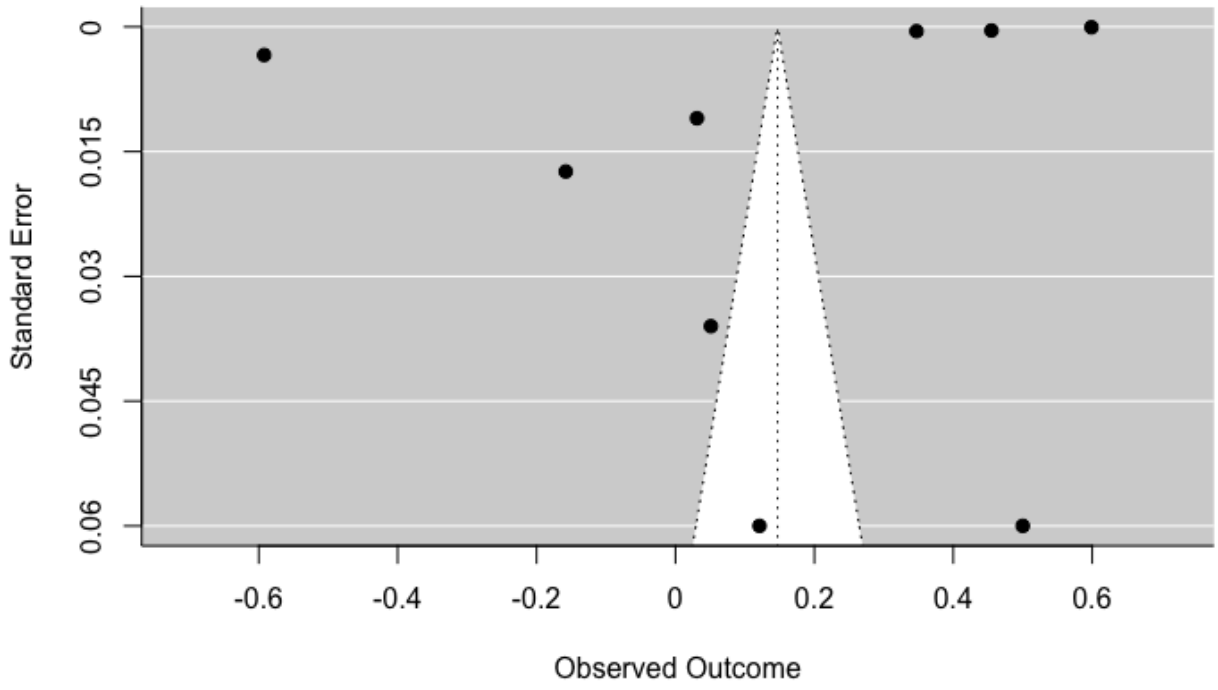


Figure 5. Funnel plot for publication bias.



The relationship between union membership and workers' wellbeing: a systematic review and meta-analysis

Table 1. Search string (PICO).

Population / Comparison	("work*")
intervention	AND ("Trade union*" OR "labour union*" OR "labor union*" OR "union*" OR "unioni*ation" OR "unionism" OR "labour relations" OR "labor relations" OR "employment relations" OR "industrial relations")
Outcome	AND ("*satis*" OR "wellbeing" OR "wellness" OR "*health*" OR "depress*" OR "anxiety" OR "*happiness" OR "mental health" OR "physical health" OR "strain" OR "self-rated health" OR "injur*" OR "illness*")

Table 2. Exclusion and inclusion criteria.

PICO categories	Inclusion criteria	Exclusion criteria
Population	Unionised working population of any gender / race and ethnicity aged 15–65.	Non-working population (including unemployed, inactive and retired people).
Intervention	Unionisation of workers, that is, workers who are members of a trade union in their workplace.	Any other work-related organisation or configuration (such as health and safety committees), trade union density, trade union presence, collective bargaining.
Comparator	Non-unionised working population of any gender / race and ethnicity aged 15–65.	Non-working population (including unemployed, inactive and retired people).
Outcome	Not considered part of the inclusion and exclusion criteria	
Other categories		
Practical issues	Study is retrievable.	Study is not retrievable.
Language	English, Italian, French and Spanish.	Any other language.
Date	From the year 2000.	Any publication dating before the year 2000.
Publication	No general restrictions on type of publication.	
Settings	No limitations.	

Table 3. Characteristics of included studies.

Author	Country / setting	Participants / sample	Methods	Dependent variable	Direction of the relationship	Statistical significance
Blanchflower et al. (2021)*	US, European countries participating in the ESS, UK	Nearly 2 million respondents from the US Gallup Daily Tracker (2008–2017), the European Social Survey (2002–2019) and the British Household Panel	OLS regression	Well-being (life satisfaction)	+	Yes
Chairman and Owen (2013)*	49 countries participating in the World Values Survey	About 57,000 observations across five waves of the World Values Survey for the years 1981–2008	Ordered probit model	Well-being (life satisfaction)	+	Yes
Donado (2015) †	USA	12,686 participants in the National Longitudinal Survey of Youth (NLSY) for the years 1988–2000	Pooled OLS regression with fixed effects estimated	Health (non-fatal occupational injuries)	+	Yes
Eisenberg-Guyot et al. (2020) †	USA	16,719 participants in the Panel Study of Income Dynamics (PSID) for the years 1985–2017	Parametric g-formulas	Health (self-rated assessment and mental illness)	+	No
Flavin and Shufeldt (2016)*	USA	Sample of 6895 from the World Values Survey for the years	OLS regression	Well-being (life satisfaction)	+	Yes

		1982, 1990, 1995, 1999 and 2006				
Gillen et al. (2002) †	USA	Sample of 255 construction workers selected between October 1995 and March 1996 participating in the Health Assessment Questionnaire, the Safety Climate Measure for Construction Sites and the Job Content Questionnaire	Three-step multiple regression and chi-squared test	Health (injury severity)	+	Yes
Green and Heywood (2015)*	UK	79,472 observations from the British Household panel Survey for the years 1995–2008	Probit adapted OLS regression	Well-being (job satisfaction)	–	Yes
Heywood et al. (2002)*	UK	A sample of 2401 from the British Household Panel for the years 1991–1994	OLS regression	Well-being (job satisfaction)	–	Yes
Lee (2022)*	South Korea	11,290 waged workers taking part in KLIPS (2003–2018), the largest and longest-running annual longitudinal survey of household and individuals	CRE panel ordered probit model	Well-being (life satisfaction)	+	No

		living in urban areas in South Korea				
Reynolds & Brady (2012) †	USA	A sample of 11,347 participants in the General Social Survey for the years 1973–2006	Logistic regression	Health (self-rated assessment)	+	Yes
Smit et al.* (2016)	South Africa	A sample of 260 workers in the iron mining industry	Structural equation modelling	Well-being (job satisfaction)	+	Yes
Wels (2020) †	UK	Sample of 9755 workers from the Understanding Society – the UK Household Longitudinal Study (UKHLS) for the years 2010–2018	The study used propensity score matching and latent growth modelling	Health (mental and physical health)	+	Yes

Note: * Study included in the meta-analysis; † study included in the narrative synthesis.