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Review

The social determinants of suicide: an umbrella review

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Abstract

Previous research has highlighted the role of social determinants of health on mental health, but their impact on suicide is less understood. The aim of this umbrella review was to systematically examine the association between 10 social determinants of health, as defined by the World Health Organization, and suicide mortality. A key word search of titles and abstracts was conducted in six digital databases for studies published up to August 24, 2023. Inclusion criteria were peer-reviewed systematic reviews and meta-analyses examining the association between these determinants and suicide. Methodological quality was assessed using an adapted AMSTAR-2 tool. A narrative synthesis, structured by social determinant, was conducted. A total of 49 records ($n = 25$ meta-analyses and 24 systematic reviews) were included in this review. Determinants with the most available evidence were housing, basic amenities and the environment ($n = 21$); income and social protection ($n = 13$); unemployment ($n = 8$); and early childhood development ($n = 6$). Limited evidence was identified for education ($n = 3$), social inclusion and nondiscrimination ($n = 3$), and working-life conditions ($n = 3$). No reviews examined the relationship between affordable health care services, structural conflict, or food insecurity and suicide. There was evidence of a modest effect of social determinants on suicide mortality. Most evidence related to unemployment, job insecurity, income and social protection, and childhood adversity. The methodological quality of the included reviews varied considerably. High-quality research fully exploring the relationship between social and environmental factors and suicide risk is needed.

Key words: social determinants of health; social factors; suicide; suicide prevention; systematic review [publication type].

Introduction

The complex and multifaceted nature of suicide is widely recognized in multilevel, interdisciplinary models of the behavior that typically conceptualize suicide risk as an interaction between distal (predisposing) factors (eg, early life adversity, genetics, family history) and proximal (precipitating) factors (eg, recent adverse life events, psychopathology).[1,2] Turecki et al.[3] proposed a biopsychosocial model that adds a third (developmental) set of factors, which include chronic substance misuse and personality traits. "Sociological, demographic, economic and environmental factors may influence any or all of the distal, developmental and proximal factors," those authors wrote.[3] In particular, socioeconomic factors appear to have a strong association with suicide, most pronounced among men.[4]

In recent times, the broader environmental and social context in which suicidal behavior occurs has received more attention from suicide researchers and in national suicide prevention strategies and action plans. These social determinants of health, defined as "the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life," including socioeconomic context, inequalities, poverty, environmental factors and health care access,[1] can be addressed across multiple population levels, ranging from global interventions (via collaborative, multisectoral action at national, regional, and local levels), to targeted, person-centered approaches. A greater focus on the social determinants of suicide may help identify opportunities to inform broader intergovernmental policies.[5] Such guidance would help target suicide prevention strategies and encourage more upstream measures to tackle health inequalities.[6]

Previous research has identified the role of social determinants in the etiology of mental ill health. For example, an umbrella review of interventions addressing the social determinants of mental health found that welfare benefits, in particular, may reduce socioeconomic inequalities associated with mental health outcomes.[7] However, to date, to our knowledge, there has been no systematic review that has examined the social determinants of health associated specifically with suicide mortality. Our aim in conducting this umbrella review was to fill this important knowledge gap.

Methods

Search strategy and eligibility criteria

This umbrella review is based on research evidence obtained from systematic reviews and meta-analyses. The review was registered with PROSPERO (identifier CRD42023447175) and follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses

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(PRISMA) guidelines for systematic reviews.[8] A key word search of titles and abstracts in six digital databases (PubMed, CINAHL, Web of Science, Scopus, PsycINFO, and Embase) was conducted for studies published up to August 24, 2023 (Table S1). Because there were no formal definitions for each social determinant identified by the World Health Organization (WHO), key words for each determinant were developed using the overall definition provided by WHO (the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life[1]) and through cross-references of a previous review of the social determinants of self-harm.[9] The key words included income and social protection; education; unemployment and job security; working life conditions; food insecurity; housing, basic amenities and the environment; early childhood development; social inclusion and nondiscrimination; structural conflict; and access to affordable health services of decent quality.

Inclusion criteria were peer-reviewed systematic reviews and meta-analyses, published in the English language, that examined the association between any social determinant of health (as defined above) and suicide mortality. Primary research studies, conferences abstracts, reports, book chapters, and dissertations were excluded. If a study examined multiple suicide-related outcomes, we only included the data specifically relating to suicide mortality. Studies were excluded when suicide mortality data could not be separated from other suicide-related outcomes (eg, ideation, suicidal behavior, suicide attempt). Similarly, any review that covered only 1 study relating to suicide mortality was excluded. A list of studies excluded on this basis can be found in Table S2.

The titles and abstracts were independently screened by 2 researchers in Covidence. Disagreement was resolved through discussion among the pair or by consulting a third researcher. Articles included for full-text screening were assessed against the inclusion criteria by the same reviewers who screened the article titles and abstracts. Reference lists of included studies were hand searched for further potentially eligible studies. Any eligible studies were uploaded to Covidence for duplicate independent screening.

Data extraction

Data extraction was conducted using a predeveloped data extraction form (Table S3), which was initially piloted in 3 of the included studies. For each eligible study, we extracted data on the number and characteristics of primary studies, effect sizes and 95% confidence intervals (CIs), qualitative findings, and quality appraisal. Data were independently extracted by 3 researchers and were cross-checked by 1 reviewer to ensure reliability. Any discrepancies were resolved through discussion.

The methodological quality of included studies was critically appraised using an adapted version of the A Measurement Tool to Assess Systematic Reviews–2 (AMSTAR-2),[10] which was specially developed for application in the assessment of systematic reviews and meta-analyses. The tool covers 16 criteria, including study selection and screening, data extraction and synthesis, as well as risk-of-bias assessment. Each criterion is rated as "yes," "partially yes," or "no." The quality of included reviews and meta-analyses is rated as high (0 or 1 noncritical weakness), moderate (>1 noncritical weakness), low (1 critical flaw with or without noncritical weaknesses), and critically low (>1 critical flaw with or without noncritical weaknesses). Because the AMSTAR-2 is only partially applicable for non-intervention systematic reviews, we adapted one critical question: "Did the review authors provide a list of excluded studies and justify the exclusions?"[11] A "yes" answer indicates the authors 1) provided a list of all potentially relevant studies that were read in full-text form but excluded from the review and 2) provided individual reasons for the exclusion of each ineligible paper. In a quality review of the AMSTAR-2 tool, including papers published in high-impact journals, only 5% included a complete list of exclusions with an accompanying justification.[12] As this itemized approach is not yet commonplace, we assigned a rating of "partially yes" if the articles included reasons for exclusions in their PRISMA flow diagram. We also excluded one noncritical question: "Did the review authors report on the sources of funding for the studies included in the review?" All studies were assessed by three reviewers independently and cross-checked; any disagreements were resolved through discussion. We provide a global rating of methodological quality (critically low, low, moderate, or high), as recommended. The adapted version of the tool is presented in Appendix S1.

We included results of all eligible systematic reviews and meta-analyses, regardless of topic overlap, in this review.[13] Study overlap was identified and managed by 2 authors and documented in an Excel file. Each overlapping study was color coded and tagged to identify overlap between primary studies in the included reviews. Using guidance from the *Cochrane Handbook for Overviews of Reviews of Interventions*,[13] we decided not to exclude studies solely on the basis of duplication of primary studies across different reviews. There were several reasons for taking this approach. As research on the social determinants of suicide as a whole is relatively understudied, we aimed to provide a comprehensive overview of the existing evidence through a public health lens. Moreover, it is plausible that the systematic reviews and meta-analyses identified in our overview offer unique perspectives and differing methodological approaches. By including all relevant reviews regardless of overlap in primary studies, we aimed to capture diverse interpretations and synthesis of the evidence, thereby enriching the breadth and depth of our overview. Furthermore, we decided not to exclude reviews on the basis of poor methodological quality. This decision was taken because some reviews may have identified key primary studies that are central to understanding the nuances of the topic area. By adopting a more inclusive approach, we aimed to mitigate the risk of overlooking important evidence and ensure a more balanced representation of the literature.

Data synthesis

Because of the heterogeneity of included studies with respect to methods, outcome measures, topic areas, and contexts, a meta-analysis was not undertaken. A narrative synthesis is provided, grouping reviews into topic areas. Meta-analysis results from the individual reviews were summarized visually using Stata, version 17. Odds ratios, relative risks, risk ratios, incidence rate ratios, hazard ratios, and standardized mortality ratios were considered equal measures of risk, due to the low rate of suicide mortality in the general population (rare disease assumption).

Results

The initial database search yielded 9913 records. An additional record was identified from hand searching reference lists. After duplicates were eliminated (n = 5206), 4707 unique records underwent screening against the inclusion criteria at the title and abstract stage. Of these, 229 (plus the additional record) proceeded to full-text screening and 181 were excluded (see Figure 1 for reasons). Ultimately, 49 records, 25 meta-analyses (Figure 2) and

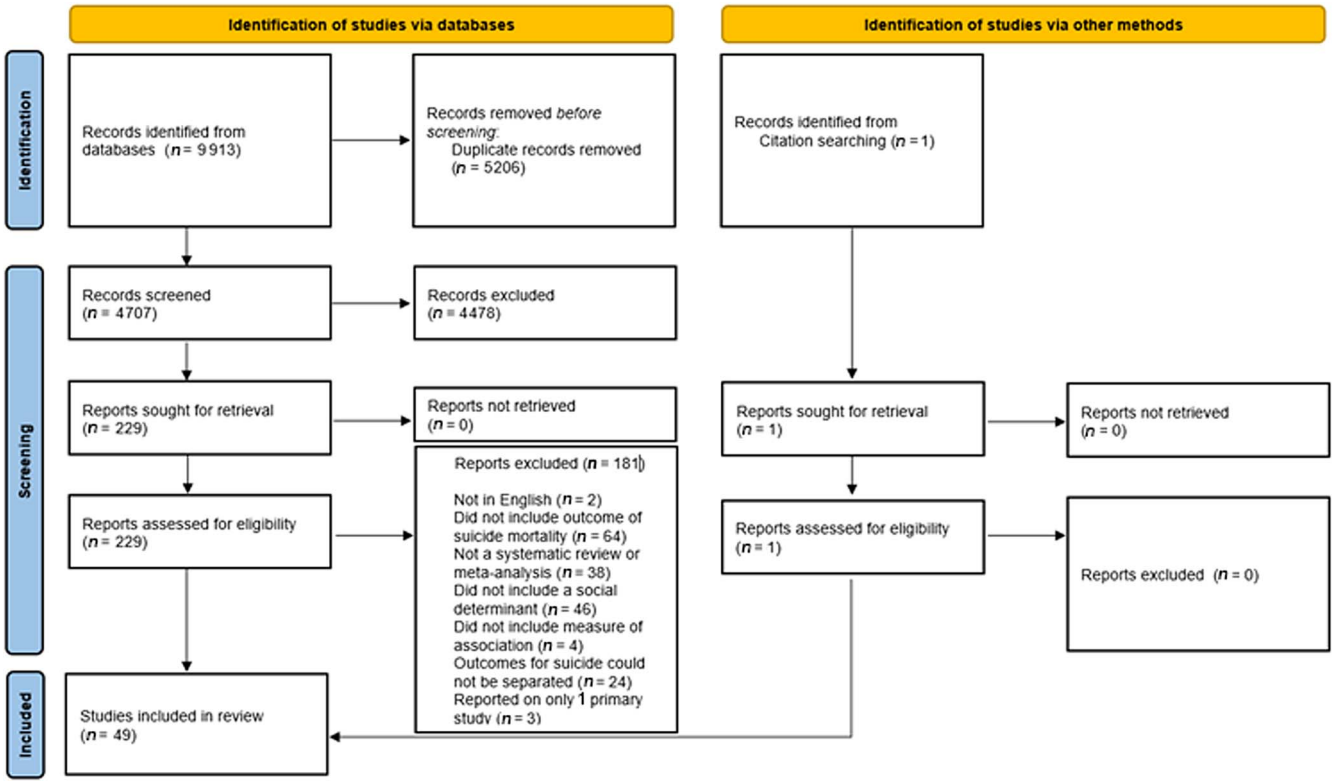

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 flow diagram for new systematic reviews that included searches of databases and other sources.

24 systematic reviews met our inclusion criteria. Figure 1 outlines the flow of information in the different phases of this umbrella review.

All social determinants explored by each review in relation to suicide mortality were included in this umbrella review. Data extracted from eligible studies included the determinant(s) of interest, participant demographics, number of studies related to suicide mortality, and results. The years of primary studies in each review ranged from 1970 to 2021, and all reviews were published between 2004 and 2023. The included articles addressed 7 of the 10 social determinants examined. The social determinants with the most available evidence were housing, basic amenities, and the environment ($n = 21$); income and social protection ($n = 13$); unemployment ($n = 8$); and early childhood development ($n = 6$). Limited evidence was identified for education ($n = 3$), social inclusion and non-discrimination ($n = 3$), and working life conditions ($n = 3$). Notably, we did not identify any reviews that examined the relationship between affordable health care service of decent quality, structural conflict, or food insecurity and suicide mortality. The characteristics of the systematic reviews and meta-analyses included in this review are detailed in the accompanying tables.

Quality of the included reviews

In this umbrella review, 25 studies were appraised as critically low in quality and 13 were categorized as low quality. Within the critical domains of the AMSTAR-2, many studies rated critically low or low for the following reasons: 1) failure to register a protocol prior to conducting the review ($n = 21$); 2) inadequate assessment of bias in the primary studies included ($n = 19$); 3) insufficient discussion of the impact bias when interpreting the results of the review ($n = 26$); and 4) failure to assess publication bias, where applicable ($n = 6$).[10] Four studies received a moderate assessment, and the remaining 7 were rated as high quality. The global ratings of systematic reviews and meta-analyses included in this review are outlined in Table 1.

Income and social protection

The 4 meta-analyses (Figure 3) and 9 systematic reviews included in this domain covered several topics, including low income,[6,14,15] financial stress,[16] debt,[17] economic recession,[18-22] poverty,[23] socioeconomic disadvantage,[24,25] and social security policy[26] (Table 2). Most of the reviews were from high- or upper-middle-income countries. Two random effects meta-analyses and one systematic review found an association between low income and the risk of suicide.[6,14,15] Two of these reported that low income was significantly associated with a higher risk of suicide among men.[6,13] One review reported a significant association between suicide mortality and debt,[17] and a more recent meta-analysis found that individuals who were financially stressed were more likely to die by suicide than were their nonexposed counterparts, and this risk was higher in men.[16] All 5 reviews examining the impact of the 2008 economic recession reported an increase in suicide rates in both men and women during that period[18-22]; 1 study reported rates to be higher in men.[16] One review reported a positive association for both individual and national poverty measures and suicide mortality.[23] Two reviews reported that people living in areas characterized by high levels of socioeconomic disadvantage were at an increased risk of suicide.[24,25] A systematic review examining the evidence regarding social security policy reforms in high-income countries found that suicide rates generally declined when measures were introduced to safeguard income (eg, retirement benefits, increased tax credits) and increased when governments

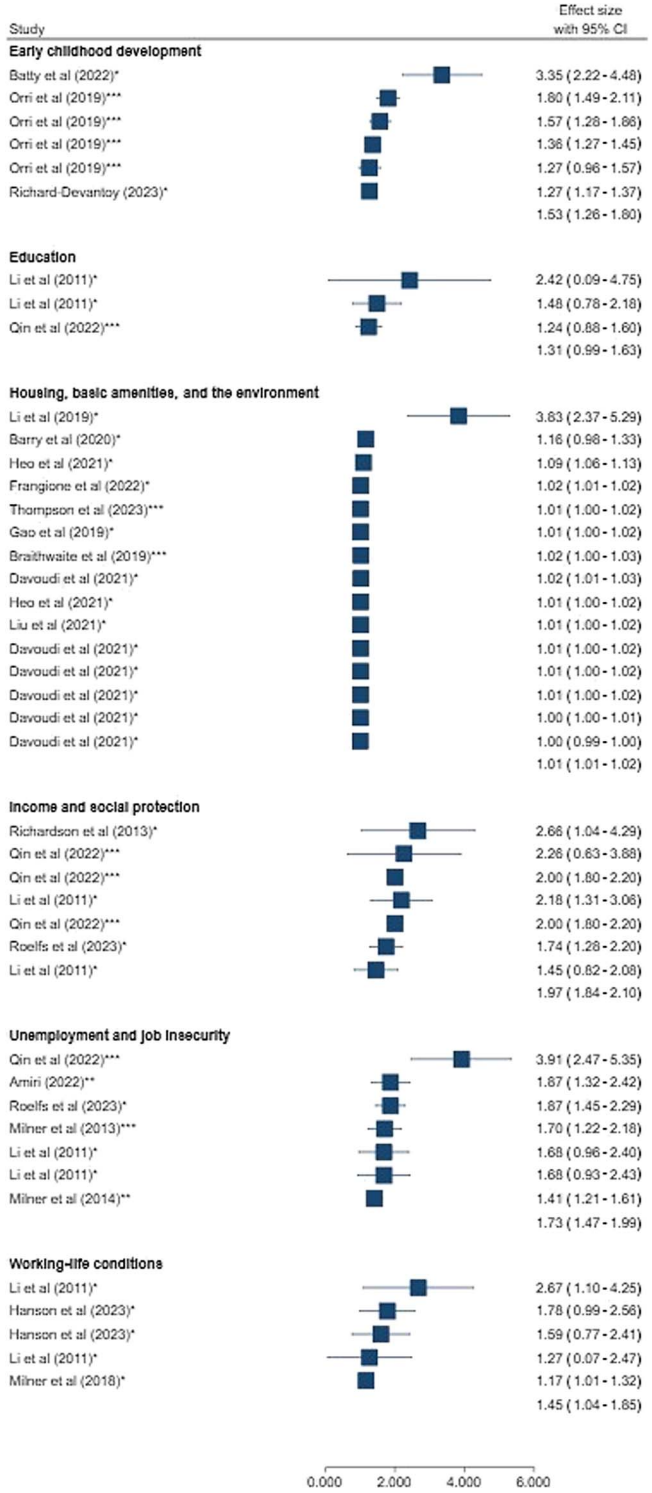

Figure 2. Forest plot visualization of meta-analytic results for social determinants of suicide. *low- or critically low–quality study, **moderate-quality study, ***high-quality study.

introduced austerity measures (eg, stricter criteria to qualify for state disability benefits).[26]

Education

Two random effects meta-analyses[6,15] [Figure 3] and one systematic review[14] found that lower levels of education were associated with suicide in men and women (Table 3).[6,14,15] The same studies, which all were conducted in high-income countries, reported that suicide was associated with a lower degree of educational attainment.

Unemployment and job insecurity

Six meta-analyses (Figure 3) and 2 systematic reviews explored the association of unemployment and unemployment benefits on suicide mortality (Table 4)[6,15,16,27-31]. Income level varied across studies; however, there was more of a focus on high-income countries. All 6 studies reported a positive association between risk of suicide and unemployment,[6,16,27-29] with 1 study reporting a higher risk in men.[13] One review found a negative correlation between unemployment benefits and suicide rates in 3 of 5 primary ecological studies, with more generous unemployment benefits resulting in fewer suicide deaths.[30]

Working-life conditions

Three random effects meta-analyses (Figure 3) investigated various components of working-life conditions, including job stressors,[32] workplace violence,[33] workplace bullying,[33] and low ranked occupation status (manual/non-skilled/blue collar workers).[6] (Table 5). Income level varied across primary studies; however, most of the research was conducted in high-income and upper-middle-income countries, with some low income countries included. One study revealed that exposure to any job stressor was associated with an increased risk of suicide.[32] Furthermore, there was a higher risk of suicide associated with lower supervisor and collegial support and low job control. Another study found that the suicide rate was higher in those exposed to workplace violence than among those nonexposed; however, suicide incidence was not significantly higher among individuals exposed to workplace bullying.[33] A meta-analysis of the association between occupation and suicide found that occupations requiring fewer skills (eg, manual labor, nonskilled workers, blue collar workers) were associated with increased risk of suicide compared with those requiring higher-level skills. This association was significant among men but not among women.[6]

Housing, basic amenities, and the environment

Twenty-one reviews (n = 10 meta-analyses [see Figure 4] and 11 systematic reviews) covered a broad spectrum of topics, including rural vs urban living[14,34-37]; temperature increase[38-42]; air pollution and ozone exposure[41,43-46]; natural disasters[47-49]; exposure to pesticides[50]; and the impact of displacement and housing affordability and foreclosure (Table 6).[51,52] Income levels differed among the primary studies, with most research conducted in high- and upper-middle-income countries, and a smaller proportion from low-income countries.

Five reviews found an association between rural residence in adulthood and risk of suicide.[14,34-37] One of these reviews reported a significant association for men but not women,[32] and another saw a greater increase in men.[34] Two reviews concluded there was an association between urban living and suicide.[34,35] Raschke et al.[14] reported that residing in metropolitan areas was associated with lower suicide rates and reduced odds of suicide compared with living in rural or urban areas of South Korea (in 2 of 3 included studies).

Five reviews, including 4 meta-analyses, reported positive, albeit weak, associations between temperature increases and suicide mortality.[38-42] Four meta-analyses reported a weak association between air pollution and suicide mortality; however,

Table 1. Global ratings of systematic reviews and meta-analyses from adapted AMSTAR-2.

Review	PICO	Protocol	Explanation of study design	Comprehensive search strategy	Duplicate study selection	Duplicate data extraction	Details of excluded studies*	Description of included studies	Risk of bias assessment (RCT'S)	Risk of bias assessment (NRSI)	Adequate discussion on impact of bias	Heterogeneity	Appropriate statistical analysis	Publication bias	Funding/conflict of interest	Overall rating
Amiri, 2022 (31)									N/A							Moderate
Asper *et al*., 2022 (18)									N/A				N/A	N/A		Moderate
Barry *et al*., 2020 (34)									N/A							Critically low
Batty *et al*., 2022 (53)									N/A							Low
Blázquez-Fernández *et al*., 2023 (61)									N/A				N/A	N/A		Critically low
Braithwaite *et al*., 2019 (45)									N/A							High
Cairns *et al*., 2017 (24)									N/A				N/A	N/A		Low
Clark *et al*., 2007 (36)									N/A				N/A	N/A		Critically low
Cogo *et al*., 2022 (51)									N/A				N/A	N/A		Critically low
Davoudi *et al*., 2021 (43)									N/A							Critically low
De Silva *et al*., 2005 (59)									N/A				N/A	N/A		Critically low
Downing, 2016 (52)									N/A				N/A	N/A		Critically low
Fässberg *et al*., 2012 (60)									N/A				N/A	N/A		Critically low
Fernandez *et al*., 2015 (49)									N/A				N/A	N/A		Critically low
Frangione *et al*., 2022 (40)									N/A							Critically low
Freire and Koifman, 2013 (50)									N/A				N/A	N/A		Critically low
Galobardes *et al*., 2004 (56)									N/A				N/A	N/A		Critically low
Gao *et al*., 2019 (39)									N/A							Critically low
Hanson *et al*., 2023 (33)									N/A							Low
Heo, Lee and Bell, 2021 (41)									N/A							Low
Lemmi *et al*., 2016 (23)									N/A				N/A	N/A		Low
Li *et al*., 2011 (6)									N/A							Critically low
Li *et al*., 2019 (37)									N/A							Low
Liu *et al*., 2021 (44)									N/A							Low
Milde *et al*., 2021 (54)									N/A				N/A	N/A		Critically low

(Continued)

the association varied across different pollutants and lag times.[41,43-46] Finally, 1 review of 4 observational studies reported a positive association between ozone exposure and suicide.[46]

Three reviews, comprising 1 meta-analysis and 2 systematic reviews, synthesized findings relating to the association between natural disasters and suicide mortality.[47-49] Overall, Safarpour et al.[47] found that suicide deaths increased significantly in the period after disasters; a subgroup analysis of 5 studies revealed that this impact was attributable to increases among men. Similarly, another review reported a positive association between flooding and suicide[48]; however these findings were based on just 2 primary studies. Fernandez et al.[49] reported conflicting evidence about changes in suicide incidence in the aftermath of a flooding event.

One systematic review presented conflicting evidence on the association between pesticide exposure and suicide mortality.

Table 1. Continued

Review	PICO	Protocol	Explanation of study design	Comprehensive search strategy	Duplicate study selection	Duplicate data extraction	Details of excluded studies*	Description of included studies	Risk of bias assessment (RCT'S)	Risk of bias assessment (NRSI)	Adequate discussion on impact of bias	Heterogeneity	Appropriate statistical analysis	Publication bias	Funding/conflict of interest	Overall rating
Milner *et al*, 2013 (89)									N/A							High
Milner *et al*., 2014 (28)									N/A							Moderate
Milner *et al*., 2018 (32)									N/A							Low
Mucci et al., 2016 (21)									N/A				N/A	N/A		Critically low
Orri *et al*., 2019 (55)									N/A							High
Oyesanya *et al*., 2015 (22)									N/A				N/A	N/A		Low
Parmar *et al*., 2016 (20)									N/A				N/A	N/A		Critically low
Qin *et al*., 2022 (15)									N/A							High
Raschke *et al*., 2022 (14)									N/A				N/A	N/A		Critically low
Rehkopf and Buka, 2006 (25)									N/A				N/A	N/A		Critically low
Richard-Devantoy *et al*., 2003 (58)									N/A							Critically low
Richarson *et al*., 2013 (17)									N/A							Critically low
Roelfs and Shor, 2023 (16)									N/A							Critically low
Safarpour *et al*., 2022 (47)									N/A							High
Satherley *et al*., 2022 (35)									N/A				N/A	N/A		Low
Shand *et al*., 2022 (30)									N/A				N/A	N/A		Critically low
Simpson *et al*., 2020 (26)									N/A				N/A	N/A		Low
Thompson *et al*., 2018 (42)									N/A				N/A	N/A		High
Thompson *et al*., 2023 (38)									N/A							High
Vidal-Ribas *et al*., 2022 (57)									N/A				N/A	N/A		Low
Virgolino *et al*., 2022 (29)									N/A				N/A	N/A		Low
Volkos and Symvoulakis, 2021 (19)									N/A				N/A	N/A		Critically low
Zhao *et al*., 2018 (46)									N/A				N/A	N/A		Moderate
Zhong et al., 2018 (48)									N/A				N/A	N/A		Critically low

Abbreviations: N/A, not applicable; NRSI, nonrandomized studies of interventions; PICO, population, intervention, comparator, outcome; RCT, randomized controlled trial.

Only 4 of 11 primary studies reported that suicide rates were higher in areas with intensive pesticide use.[50]

In a systematic review investigating suicide rates among displaced populations, several studies suggested that suicide rates were lower among refugees who have been granted asylum compared with the host populations.[51]

Finally, a systematic review, including 2 population-level studies and 1 individual-level study, synthesized the evidence regarding housing and suicide.[52] The first population-level study found no correlation between unaffordable housing and suicide, whereas the second study reported an association between the age-adjusted suicide rate and foreclosures, particularly among

Table 2. Characteristics of studies relating to income and social protection.

Reference review type	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Roelfs et al., 2023[16] Meta-analysis	To determine the suicide risk after unemployment or financial stress	Individuals with mental illness	23	Case-control, cohort	2000-2019	High income: Denmark, England, Hong Kong, New Zealand, United States, Taiwan, Italy, Estonia, Germany, Canada, Sweden Upper-middle income: Turkey Lower-middle income: India	Financially stressed individuals were 74.0% more likely to die by suicide (95% CI, 36.8-121.5). Subgroup analyses showed that the relative suicide risk was lower than for studies that controlled for baseline physical health (47.0% elevated risk) and slightly higher than for studies that controlled for baseline mental health (78.4% elevated risk). Neither was statistically significant. The authors used subgroup analysis to assess the impact of bias.
Qin et al., 2022[15] Meta-analysis	To provide an overview of research on this topic, to determine the prevalence of socioeconomic, psychiatric, and physical health risk factors in suicide decedents of middle age, and to present the pooled risk of suicide conferred by these factors at midlife	Suicide decedents	3	Cross-sectional, cohort	2003-2018	High income: New Zealand, Hong Kong, Sweden	Low income was associated with a 2.26 (95% CI, 1.16-4.41) relative risk of suicide. In a subgroup analysis by sex the relative risk for men was 2.00 (95% CI, 1.81-2.21) and 1.71 (95% CI, 1.46-1.99) for women. All 3 studies were of high quality.
Richardson et al., 2013[17] Meta-analysis	To systematically review the relationship between personal unsecured debt and health	Individuals with unsecured debt	4	Psychological autopsy studies (case-controlled)	2006-2010	High income: China	The results showed a strong relationship between suicide and debt, with suicide being associated with having nearly an 8-fold risk of debt. Risk of bias was not assessed.
Li et al., 2011[6] Meta-analysis	To systematically review 1) the risk of suicide associated with high-prevalence disorders and key SES measures in population-based studies of suicide; and 2) estimates of the population attributable risk of suicide associated with psychiatric disorders and SES measures	Not reported	4	Case–control, cohort	1994-2003	High income: Denmark, Canada, Sweden, Finland, New Zealand, Lithuania	The pooled relative risk for suicide associated with low income was 2.18 (95% CI, 1.47-3.22) and 1.45 (95%, CI 0.95-2.21) for male and female participants, respectively. The quality of the included studies was not reported.

(Continued)

Table 2. Continued

Reference review type	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Asper et al., 2022[17] Systematic review	To assess the impact of the COVID-19 pandemic, previous pandemics	General population	37	Longitudinal cohort, repeated cross-sectional	2010-2020	High income: Italy, Spain, Canada, England, the United States, and South Korea Upper-middle income: Greece, and the European Union	19 studies found increased suicide rates at the level of the total population after the start of the 2008 economic crisis. Some studies reported increases in suicide rates in specific population subgroups, among men, or attributable to specific factors such as unemployment. Studies relating to suicide and the economic crisis were of moderate to high quality.
Raschke et al., 2022[14] Systematic review	To investigate socioeconomic risk factors for suicidal behaviors (suicidal ideation, attempted suicides, and completed suicides) in South Korea	General population	6	Prospective cohort, retrospective cohort. Case–control	2006-2019	High income: South Korea	Low income is significantly associated with an increased risk of suicide. Outcomes were controlled for covariates such as marital status, area of residence, and age. Risk of bias was not assessed.
Simpson et al., 2021[26] Systematic review	To provide a synthesis of observational literature on the effects on and inequalities in mental health of social security reforms	Adults aged ≥25 years	4	Longitudinal studies	2016-2020	High income: United Kingdom, United States	Suicide rates generally declined when measures were introduced to safeguard income (retirement benefits, increased tax credits). Suicide rates increased when governments introduced austerity measures (stricter criteria for state disability benefits). All 4 studies were of high quality.
Volkos and Symvoulakis 2021[19] Systematic review	To identify the extent to which the economic crisis of the past decade has influenced mental health issues in daily life, by offering an in-depth analysis of such an effect	General population	2	Retrospective observational analysis	2013 and 2018	Upper-middle income: Greece Varied: 27 European countries, 18 countries in the Americas	A worldwide report showed that there was an increase in suicides in men in 27 European and 18 American countries after the 2008 global financial crisis. The overall quality and risk of bias in the studies included in this review were not discussed by the authors.

(Continued)

Table 2. Continued

Reference review type	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Cairns, 2017[24] Systematic review	To explore the extent to which area-level socioeconomic disadvantage is associated with inequalities in suicidal behavior and self-harm in Europe	General population	22	Repeated cross-sectional, prospective, and retrospective cohorts;, time series; cross-sectional	2005-2015	High income: England, Scotland, Northern Ireland, Spain, Republic of Ireland, Finland, Denmark, Sweden, Portugal, the Netherlands, Switzerland Italy, and Portugal) Upper-middle income: Slovakia, Hungary	Findings provide strong evidence of increased risk of suicide in areas experiencing high levels of socioeconomic disadvantage across Europe. This was consistent across different countries, all age groups, and men and women, but was particularly the case for men. All studies included were classified as being of medium to high quality.
Lemmi et al., 2016[23] Systematic review	To understand the association between suicidal ideations and behaviors and economic poverty in low- and middle-income countries	General population	18	Ecological, economic modeling, interrupted time series, case–control, cross-sectional	Not reported	Varied: WHO regions: Americas, Africa, Eastern Mediterranean region, Europe, Southeast Asia, and the Western Pacific	Investigated the impact of poverty on suicide mortality, drawing from the findings of 18 studies. Across these studies, a total of 31 associations were examined, focusing on various measures of poverty at the individual and national levels. The majority reported a positive correlation between poverty and suicide mortality. Most studies were of high and acceptable quality (not reported for individual studies).
Mucci et al., 2016[21] Systematic review	To systematically review the impact of the economic crisis on the health of workers	General population	4	Cross-sectional, time series	2013-2015	High income: South Korea, Spain, Italy Varied: 54 countries (27 in Europe, 18 in the Americas, 8 in Asia, and 1 in Africa)	All 4 studies included in this review relating to suicide mortality and economic crisis showed that economic crisis and rise in unemployment were associated with increases in suicide. Quality was determined by study type, parameters used, and data collection methods. No studies were classified as high quality (not reported for individual studies).

(Continued)

Table 2. Continued

Reference review type	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Parmar et al., 2016[20] Systematic review	To systematically identify, critically appraise, and synthesize empirical studies about the impact of the 2008 financial crisis in Europe on health outcomes		16	Not reported	2008-2015	High-income: Spain, United Kingdom, France, England, Finland, Iceland, Ireland, United Kingdom (England and Wales) Upper-middle income: Greece Varied: 54 countries (27 European), 29 European countries, 8 Western European countries	The majority of the 16 studies reported a significant increase in suicides during the 2008 financial crisis. Of the 16 studies included in this review, 14 were classified as weak, the remaining 2 were of moderate quality.
Oyesanya, Lopez-Morinigo and Dutta, 2015[22] Systematic review	To provide a systematic update of the evidence on the relationship between economic recession and suicide	General population	38	Time series, panel study, cohort	Not reported	High income: United States, Japan, South Korea, Sweden, Spain, Italy Upper-middle income: Russia, 22 former Soviet Bloc countries, Greece Varied: 27 European countries, 18 American countries, 8 Asian countries 1 South African country, Europe, and North America	31 studies found a positive association between economic recession and increased suicide rates after the onset of recession. Two studies reported a negative association between economic recession and suicide (ie, economic recession appeared to be a protective factor for suicide at the ecological level). Two studies did not find an association, and 3 studies were inconclusive in their findings. The authors provide a detailed summary of bias/quality assessment but did not use a standardized tool.
Rehkopf and Buka, 2006[25] Systematic review	To synthesize and summarize the current state of evidence regarding variation in suicide rates across local areas, with implications for suicide prevention and future research	General population	86	Cross-sectional	1970-2004	Varied: Europe, Asia, North America, and Australia	Among the 221 analyses reported in 86 studies, 45% reported a significant relationship between the socioeconomic character of a region and suicide and 55% reported no relation. 70% reported an inverse association, such that areas of higher socioeconomic position were associated with lower rates of completed suicide. Risk of bias/quality of this study was not reported.

Abbreviations: SES, socioeconomic status; WHO, World Health Organization.

Table 3. Characteristics of studies relating to education.

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Qin et al., 2022[15] Meta-analysis	To provide an overview of research on this topic, to determine the prevalence of socioeconomic, psychiatric, and physical health risk factors in suicide decedents of middle age, and to present the pooled risk of suicide conferred by these factors at midlife	Suicide decedents	8	Cross sectional, cohort	2003-2017	High income: New Zealand, Japan, South Korea, Hong Kong, Spain, Sweden, Italy, Norway	Compulsory education only (≤9 years of education) was associated with a 1.24 (95% CI, 0.93-1.66) relative risk of suicide. In a subgroup analysis by sex, the relative risk for men was 1.44 (95% CI, 1.08-1.93) and 1.12 (95% CI, 0.71-1.76) for women. All studies relating to education were of high quality.
Li et al., 2011[6] Meta-analysis	To systematically review 1) the risk of suicide associated with high-prevalence disorders and key SES measures in population-based studies of suicide; and 2) estimates the population attributable risk of suicide associated with psychiatric disorders and SES measures	Not reported	4	Cohort, case–control	1994-2007	High income: Denmark, Canada, Sweden, Finland, New Zealand, Lithuania	The pooled relative risk for suicide associated with low (compared with high) educational achievement was 2.18 (95% CI, 1.47-3.22) and 1.46 (95% CI, 0.94-2,34) for men and women, respectively. The pooled risk for suicide associated with level of education (less than secondary schooling) was 2.42 (95% CI, 1.03-5.70) for men and 1.48 (95% CI, 0.94-2.34) for women. The quality of the included studies was not reported.
Raschke et al., 2022[14] Systematic review	To investigate socioeconomic risk factors for suicidal behaviors (suicidal ideation, attempted suicides, and completed suicides) in South Korea	General population	3	Ecological, case–control	2006-2015	High income: South Korea	Lower levels of educational attainment were associated with higher rates of suicide deaths. College education was linked to the least risk of death by suicide in all considered studies. Differences in suicide mortality between the educational groups grew larger over time and were more profound in men than in women. Risk of bias was not assessed.

Abbreviation: SES, socioeconomic status.

Table 4. Characteristics of studies relating to unemployment and job insecurity.

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Rolfes and Shor, 2023[16] Meta-analysis	To determine the suicide risk following unemployment or financial stress	Individuals with mental illness	46	Case–control, cohort	1990-2019	High income: Denmark, England, New Zealand, United States, Sweden, the Netherlands, Estonia, Germany, Taiwan, Belgium, Finland, Canada, Australia, United Kingdom, Japan Upper-middle income: Turkey, Iran Lower-middle income: India Low income: Rwanda	Unemployed individuals were 59.0% more likely to die by suicide (95% CI, 27.8- 97.9) than those in active employment. For studies of the general population, the unemployed were 87.4% more likely to die by suicide (95% CI, 50.1-134.1). Subgroup analyses showed no significant differences by sex. The quality of the included studies was not reported.
Amiri, 2022[31] Meta-analysis	To investigate the impact of unemployment on suicidality	General population, elderly, individuals with heroin use disorder, psychiatric patients	21	Cross-sectional, case–control, prospective cohort	1987-2019	High income: United States, Denmark, New Zealand, Taiwan, Sweden, Italy, France, the Netherlands, Canada, Australia, Puerto Rico, South Korea, Germany, United Kingdom, Slovenia, Finland, Israel, Belgium, Japan Upper-middle income: South Africa Lower-middle income: India, Bhutan, Iran, Nigeria	Unemployment was associated with an increased odds of suicide mortality (odds ratio = 1.87; 95% CI, 1.40-2.50). The authors assessed and discussed the quality of each study under the following domains: selection bias, confounding, data collection, and attrition.
Qin et al., 2022[15] Meta-analysis	To provide an overview of research on this topic, to determine the prevalence of socioeconomic, psychiatric, and physical health risk factors in suicide decedents of middle age, and to present the pooled risk of suicide conferred by these factors at midlife.	Suicide decedents	7	Cross-sectional, cohort	2003-2018	High income: New Zealand, Japan, China, South Korea, Denmark, Spain, Ireland, Italy, Norway	Unemployment was associated with a 3.91 (95% CI, 2.73-5.59) relative risk of suicide. In a subgroup analysis by sex, the relative risk for men was 4.10 (95% CI, 2.20-8.33) and 3.47 (95% CI, 1.95-6.16) for women. 1 study was of low quality, the remaining 6 were of moderately high quality.

(Continued)

Table 4. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Milner et al, 2014[28] Meta-analysis	To quantify the effects of adjustment for mental health on the relationship between unemployment and suicide	Not reported	5	Cohort studies	2000-2012	High income: Denmark, Sweden	The overall effect of unemployment was associated with a 1.41 relative risk of suicide (95% CI, 1.21-1.60). After adjusting for mental health, the relative risk of suicide after unemployment was reduced by almost 37% (1.15; 95% CI, 1.00-1.30). Mental health was considered a confounder rather than an effect modifier. Studies included in the meta-analysis were deemed to be of high quality.
Milner et al., 2013[27] Meta-analysis	To summarize evidence to date on the effects of duration of unemployment on suicide attempts and death	Unemployed individuals	6	Cohort	2000-2010	High income: Denmark, Sweden, Finland	The pooled relative risk of suicide associated with longer unemployment (average follow-up time, 7.8 years) compared with those currently employed was 1.70 (95% CI, 1.22-2.18). Only cohort studies were included in the meta-analysis, because they were of higher quality than other observational study designs.
Li et al., 2011[6] Meta-analysis	To systematically review 1) the risk of suicide associated with high-prevalence disorders and key SES measures in population-based studies of suicide; and 2) estimates the population attributable risk of suicide associated with psychiatric disorders and SES measures	Not reported	4	Case–control, cohort	2000-2003	High-income: Denmark, Canada, Sweden, Finland, New Zealand, Lithuania	The pooled relative risk for suicide associated with unemployment was 1.68 (95% CI, 1.11-2.54) and 1.68 (95% CI, 1.09-2.59) for men and women, respectively. The quality of the included studies was not reported.

(Continued)

Table 4. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Virgolino et al., 2022[29] Systematic review	To review, integrate, and summarize evidence about the association between unemployment and anxiety disorders, mood disorders, and suicidal behavior, and identify variables affecting this association	General population (aged ≥15 years)	93	Ecological, cross-sectional, case–control, cohort	1992-2019	Varied: America, Asia, Australia, Europe	Most studies included in the review show a strong positive association between unemployment and suicide mortality. Provided evidence demonstrated that men and women respond differently to unemployment. Risk of suicide was generally higher for unemployed men. Most included studies were of medium-high quality (4.8% were of low quality).
Shand, Duffy, and Torok, 2021[30] Systematic review	To assess whether government responses to unemployment can moderate the impact of unemployment on rates of suicide and self-harm	General population	6	Ecological, time series	2009-2017	High income: Greece, Ireland, Italy, Portugal, Spain, United States, European Union, North America, 20 OECD countries	Based on 3 of 5 studies, unemployment benefits were negatively associated with suicide rates. There is evidence that active unemployment policies and employment protection legislation have beneficial effects. Policies had a small but meaningful impact on suicide rates in men. Quality assessment not undertaken.

Abbreviation: OECD, Organization for Economic Cooperation and Development.

Table 5. Characteristics of studies relating to working-life conditions.

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Hanson et al., 2023[33] Meta-analysis	To investigate the association of workplace violence, workplace bullying, and the risk of subsequent suicide attempts or death by suicide	Individuals of working age (15–65 years)	4	Prospective cohort	1995-2018	Not reported	Suicide death was 1.78 (95% CI, 1.16-2.73) times higher in those exposed to workplace violence than in the unexposed. Similarly, death by suicide was 1.59 times higher in individuals exposed to workplace bullying, though this association was not significant (95% CI, 0.97-2.62). The studies included in this review were classed as high risk of bias.
Milner et al., 2018[32] Meta-analysis	To investigate whether exposure to job stressors was associated with a greater risk of suicidal ideation and/or behaviors	General population, male sawmill workers, medical school cohort	6	Case–control, cohort	2007-2017	High income: Australia, Canada, Germany, Japan	There was a higher risk of suicide associated with lower supervisor and collegial support and low job control. There were no significant associations between job demands or job strain and suicide death. Exposure to any job stressor was associated with a 1.17 (95% CI, 1.03-1.34) increased risk of suicide. The quality of the included studies was not reported.
Li et al., 2011[6] Meta-analysis	To systematically review 1) the risk of suicide associated with high prevalence disorders and key SES measures in population-based studies of suicide; and 2) estimates the population attributable risk of suicide associated with psychiatric disorders and SES measures	Not reported	3	Case–control, cohort	2001-2007	High income: Denmark, Canada, Sweden, Finland, New Zealand, Lithuania	The pooled relative risk for suicide associated with low occupation (manual/nonskilled/blue collar workers) was 2.67 (95% CI, 1.53-4.68) and 1.27 (95% CI, 0.54-2,94) for men and women, respectively. The quality of the included studies was not reported.

Abbreviation: SES, socioeconomic status.

Table 6. Characteristics of studies relating to housing, basic amenities, and the environment.

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Thompson et al., 2023[38] Meta-analysis	To comprehensively analyze the current evidence regarding the associations between ambient temperature and mental health outcomes	General population	9	Case crossover	2011-2021	High income: United States, Australia, Taiwan, England, Wales Upper-middle income: Turkey Varied: Korea	A 1°C increase in mean monthly temperature was associated with an increase in the incidence of suicide by 1.5% (95% CI, 0.8-2.2). A 1°C increase in mean daily temperature was associated with an increase in incidence of 1.7% (95% CI, 0.3-3.0). A 1°C increase in mean monthly temperature was associated with a risk ratio of 1.01 (95% CI, 1·00-1.01). Of the studies included, 1 study was classed as having a high risk of bias, 1 as moderate risk, and the remaining 7 as low risk of bias.
Frangione et al., 2022[40] Meta-analysis	To examine the association between either daily or weekly variations for 8 meteorological variables and suicide outcomes (attempts or deaths)	General population	16	Time-series, case crossover, time-stratified, and case crossover	1997-2020	High income: United States, Austria, Columbia, China, Japan, United Kingdom, Spain, Germany, Southern Israel Upper-middle income: Brazil, Kazakhstan, Turkey Varied: 12 countries (not named)	Ambient temperature was positively associated with suicide mortality incidence. In a random-effect meta-analysis, the overall relative risk per 1°C increase in temperature was 1.016 (95% CI, 1.013-1.019). 1 study included in this meta-analysis was rated poor, 2 as moderate, and the remaining 13 studies were of high quality.
Davoudi et al., 2021[43] Meta-analysis	To explore the association between short-term exposure to air pollution and suicide mortality, with an emphasis on different lag times	General population	11	Case crossover, time series	2010-2019	High income: South Korea, United States, China, Japan, Belgium, Taiwan Upper-middle income: Colombia, Mexico Varied: Northeast Asia	Results indicate a positive, though weak, association between air pollution and suicide mortality. Pollutants such as NO_2, SO_2, PM_{10}, and $PM_{2.5}$, particularly within the cumulative lag of 0-1 day, were associated with heightened risks of suicide within the general population. All studies included in the meta-analysis were of moderate to high quality.

(Continued)

Table 6. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Heo, Lee, and Bell, 2021[41] Meta-analysis	To investigate suicide risk associated with short-term exposure to ambient temperature and air pollution	General population	18	Time series, case crossover	1994-2019	England, Spain, Austria, United States, Finland, South Korea Upper-middle income: Brazil, Columbia, Kazakhstan Varied: 29 European countries	Relative risk of daily suicide rates per IQR increase in daily temperature was 1.09 (95% CI, 1.06-1.13). 14 studies included in the meta-analysis were deemed "probably low risk of bias," with the remaining 4 "high risk."
Heo, Lee, and Bell, 2021[41] Meta-analysis	To investigate suicide risk associated with short-term exposure to ambient temperature and air pollution	General population	13	Time series, case crossover	2010-2019	United States, Canada, South Korea, Belgium, China, Japan, Taiwan Upper-middle income: Colombia, Mexico Varied: Asia	Relative risks of suicide per IQR increase in $PM_{2.5}$, PM_{10}, and NO_2 were 1.02 (95% CI, 1.00-1.05), 1.01 (95% CI, 1.00-1.03), and 1.03 (95% CI, 1.00-1.07). Ozone, SO_2, and CO were not associated with suicide. Primary studies included in the meta-analysis were classed as "probably low risk" of bias and "definitely low risk" of bias.
Liu et al., 2021[44] Meta-analysis	To determine the overall relationship between PM exposure and depression/suicide	General population	10	Time-series, time stratified case crossover, cohort	2010-2019	High-Income: United States, Belgium, Japan, China Upper-middle income: Colombia, Mexico Varied: Korea	For a 10 μg m^{-3} increase in short-term exposure to $PM_{2.5}$, there was a 2% increased risk of suicide. A 10 μg m^{-3} increase in short-term exposure to PM_{10} was associated with a 1% increase in suicide risk. Of the studies included in the meta-analysis, 3 were rated moderate and 7 as high quality.
Barry et al., 2020[34] Meta-analysis	To determine whether those living in rural areas are more likely to complete or attempt suicide	People living in high-income English-speaking countries	36	Prospective cohort, retrospective cohort, case control, cross-sectional, ecological	2006-2017	High-income: Canada, United States, United Kingdom, Australia	Living in rural areas was associated with an increased risk of suicide. Sex may moderate this association with men living in rural areas being at a greater risk of suicide than men living in urban areas. Women may be at a similar risk regardless of residence. 12 studies were rated as high quality and the remainder as moderate-low quality.

(Continued)

Table 6. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Safarpour et al., 2020[47] Meta-analysis	To measure the rate of suicide death after disasters	General population	11	Not reported	1999-2018	High income: Japan, United States, Taiwan, China Lower-middle Income: Sri Lanka	11 studies related to suicide death rate before and after disasters estimated suicide death rates of 13.61 per 100 000 people before disasters and 16.68 per 100 000 people after disasters. In a subgroup analysis of 5 studies according to sex, the suicide death rate before and after disasters was 28.36 and 32.17 among men, and 12.71 and 12.69 among women per 100 000 people, respectively, This indicated an increase of 3.8 suicides among men and no change for women.
Braithwaite et al., 2019[45] Meta-analysis	To investigate quantitative associations between PM exposure and multiple adverse mental health outcomes	General population	4	Case crossover	2010-2017	High income: United States, Belgium, Republic of Korea, China	The combined effect estimates per 10 $\mu g\ m^{-3}$ PM_{10} increment were not statistically significant at lag 0–1 day (RR = 1.01; 95% CI, 0.99-1.03), but they showed significance at lag 0–2 days (RR = 1.02; 95% CI, 1.00-1.03). All 4 studies included in the meta-analysis were rated as good quality.
Gao et al., 2019[39] Meta-analysis	To investigate if sunlight hours and temperature can affect the risk of suicide	General population	11	Cross-sectional	Not reported	High income: Australia, England, Wales, Italy, Taiwan, New Zealand, Austria, Greece, Norway Upper-middle income: Brazil, Columbia, Kazakhstan Varied: Korea	A random-effects meta-analysis showed that a 1°C increase in temperature was significantly associated with a 1% increase in the incidence of completed suicide. All studies included in the meta-analysis were moderate to high quality.
Raschke et al., 2022[14] Systematic review	To investigate socioeconomic risk factors for suicidal behaviors (suicidal ideation, attempted suicides, and completed suicides) in South Korea	General population	3	Ecological, case-control	2006-2015	High income: South Korea	2 of the 3 included studies found that metropolitan residence was associated with lower odds for suicide compared with living in rural or urban areas. Because of the limited number of studies exploring this association, these findings are insufficient to establish definitive conclusions. Risk of bias for the individual studies was not assessed.

(Continued)

Table 6. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Satherley et al, 2022[35] Systematic review	To review the effects of urban living on suicidality and self-harm in the United Kingdom and Ireland	Urban residents	9	Ecological	1960-2019	High income: United Kingdom, Ireland	3 of 9 studies reported a significant association between urban living and suicide (urban areas were more associated with suicide than rural areas). In 5 of these studies, adjustments were made for area-level socioeconomic deprivation; this socioeconomic deprivation largely accounted for higher rates of suicide in urban areas ($n = 3$ of 5 studies). One study reported greater suicide rates in Scottish urban areas with overcrowding and tenement housing. Methodological quality could not be determined for individual studies included in the review.
Cogo et al., 2021[51] Systematic review	To synthesize from published literature what is known about the rates and prevalence of suicide and suicidal behavior among displaced people.	Displaced people: refugees granted asylum; refugees in camps; asylum seekers; internally displaced people	11	Monitoring study, cross-sectional, retrospective cohort	2006-2021	High income: Canada, Denmark, Sweden, the Netherlands Upper-middle income: Thailand Low income: Sudan	Suicide rates ranged considerably from 4.0 to 290 per 100 000 person-years across the 11 studies. It was not possible to draw conclusions about the comparative rate of suicide in refugees and host populations. The results from different studies are inconclusive, with several studies suggesting that rates of suicide may be lower in refugees granted asylum than in the host populations. All studies relating to suicide mortality were low quality.
Li and Katikireddi, 2019[37] Systematic Review	To review the incidence of suicide in rural and urban China among the elderly	Elderly people (aged ≥60 years) living in China	7	Register studies	1993-2016	High income: China	Elderly individuals residing in rural regions of China had an almost 4-fold higher likelihood of suicide compared with their urban counterparts. All studies were rated as moderate-low risk of bias.

(Continued)

Table 6. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Thompson et al., 2018[42] Systematic review	To describe the mental health effects of high ambient temperatures and heat waves	General population	17	Time series, case crossover	1994-2016	High-Income: Switzerland, Austria, United States, Canada, Mexico, Kazakhstan, Finland, Japan, Taiwan, Korea, Belgium, England, Wales, Australia	15 of 17 studies found a positive and significant association between increasing temperatures and suicide frequency. Two articles reported, but did not quantify, a positive relationship. Two articles found no significant relationship between suicide and temperature. Most studies were rated fair. The quality of many studies was affected by omission and lack of detail on confounding factors.
Zhao et al., 2018[46] Systematic review	To systematically review the epidemiologic studies on ambient ozone exposure and mental or behavioral disorders to describe consistent associations as they exist or identify gaps in our current knowledge	General population	4	Case crossover, time-series, cross-sectional	2008-2017	High income: Germany, Taiwan, Belgium, Canada Varied: Korea	Although studies suggest a positive correlation between elevated ozone levels and suicide rates, the low quality of the included studies makes it difficult to establish definitive conclusions.
Zhong et al., 2018[48] Systematic review	To systematically map the long-term health impacts of flooding (including long-term health outcomes, epidemiologic trends, and impact factors)	General population	2	Mortality case-series, prospective cohort	1996 and 2003	High income: China, United States	Reported a positive association between flooding and suicide. Methodological quality could not be determined for individual studies included in the review.
Downing, 2016[52] Systematic review	To understand the direct and spillover effect of foreclosures on several health-related outcomes	General population	3	Not reported	2014-2015	High income: United States Varied: 20 European Union countries	2 studies on suicide at the population-level were included. In a study of 20 European countries, no correlation between unaffordable housing and suicide was found. In a study conducted in the United States, an association between the age-adjusted suicide rate and foreclosures was observed in adults aged 46–64 years.

(Continued)

Table 6. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
							One study on individual-level foreclosures and suicide reported that the number of foreclosure-related suicides increased during the foreclosure crisis. Risk of bias was not assessed.
Fernandez et al., 2015[49] Systematic review	To systematically map and review available scientific evidence on mental health impacts of floods caused by extended periods of heavy rain in river catchments	General population	2	Longitudinal studies	1998 and 2013	High income: United States, Australia	The evidence regarding suicide after a flood event was contradictory. Suicide rates increased after a flood event in the United States, but this finding was not replicated in Australia. No quality assessment tool was used. Authors discuss the limitations and biases inherent in longitudinal study design, which may have influenced the findings.
Freire and Koifman, 2013[50] Systematic review	To systematically review epidemiologic literature on the relationship of pesticide exposure with depression and suicide	General population, agricultural workers, rural residents, pesticide applicators and their spouses	11	Ecological, cross-sectional, nested case-control, case-control, prospective cohort	1996-2011	High income: Spain, United States, New Zealand, Canada, Australia Upper-middle income: Brazil	4 of the 11 studies found that suicide rates were higher in areas with intensive pesticide use compared with areas with lower pesticide use. Risk of bias was not assessed.
Clark et al, 2007[36] Systematic review	To assess the strength of the evidence of the impact of the physical environment on mental health and well-being	General population	6	Cross-sectional	1998-2005	High income: Australia, United States	Consistent evidence for an association between rural residence in adulthood and suicide rates for men but not women. The association between rural residence and suicide may relate to a lack of employment opportunities and financial difficulties in rural areas. All studies included in the review were of low quality.

Abbreviations: CO, carbon monoxide; NO_2, nitrogen dioxide; SO_2, sulfur dioxide; PM, particulate matter; $PM_{2.5}$, fine inhalable particulate matter; PM_{10}, inhalable matter; RR, risk ratio.

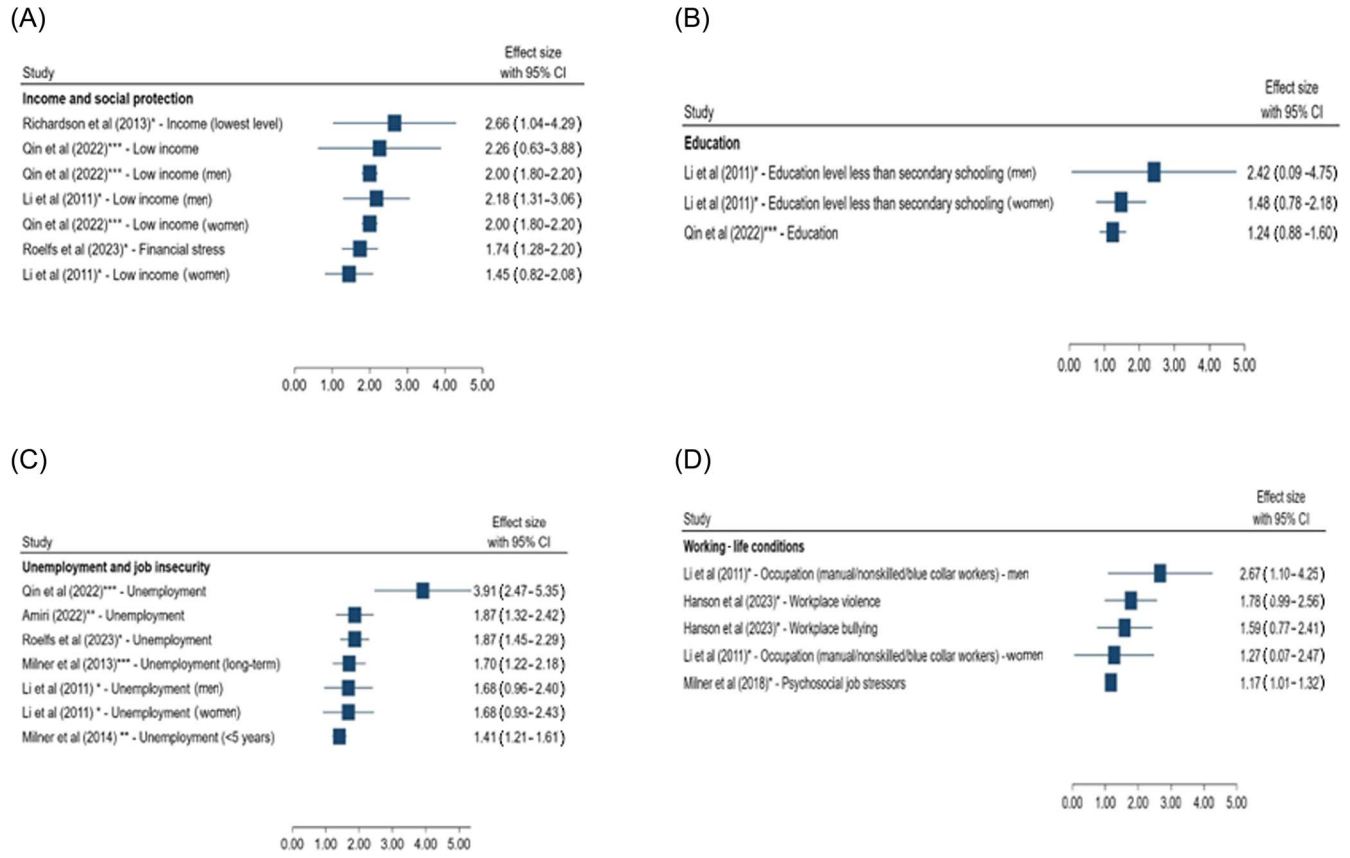

Figure 3. Forest plot visualization of meta-analyses results for A) income and social protection; B) education; C) unemployment and job insecurity; and D) working life conditions. ∗low- or critically low–quality study, ∗∗moderate-quality study, ∗∗∗high-quality study.

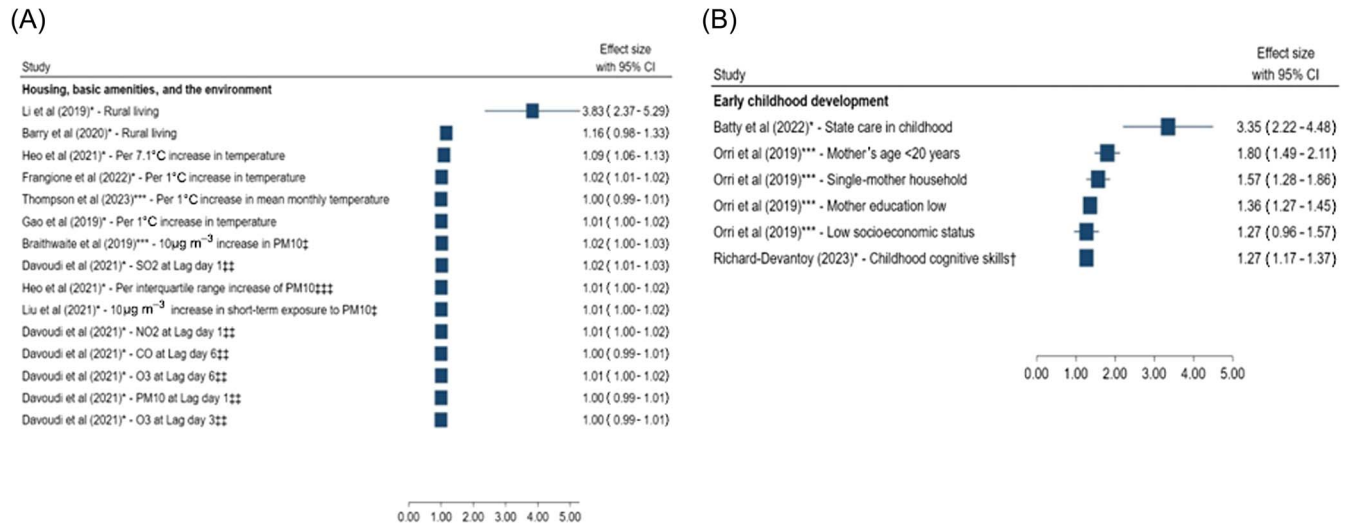

Figure 4. Forest plot visualization of meta-analyses results for A) housing, basic amenities and the environment and B) early childhood development. *low- or critically low–quality study, ∗∗moderate-quality study, ***high-quality study. ‡Measures were reported per 10 μg m^{-3} increase in fine particulate matter ($PM_{2.5}$) or fine inhalable particles (PM_{10}); ‡‡measures were reported per 10 μg m^{-3} increase in nitrogen dioxide, sulfur dioxide, ozone, PM_{10}, and $PM_{2.5}$; and per 0.5 mg m^{-3} increase in CO at days 1, 2, 3, 4, and 6; ‡‡‡measures were reported per IQR increase $PM_{2.5}$, PM_{10}, O_3, SO_2, nitrogen dioxide, and CO. "t" indicates converted from Cohen's *d*.

adults aged 46-64 years. The individual-level study reported an increase in foreclosure-related suicides during the foreclosure crisis in 2007.

Early childhood development

Three systematic reviews and 3 meta-analyses (Figure 4) investigated various aspects of early childhood development, including child welfare services,[53,54] perinatal exposures,[55-57] and cognitive skills[58] (Table 7). Where reported, all evidence came from high-income countries. A meta-analysis reported a significant association between adults exposed to any form of state care in childhood and the risk of suicide in adulthood.[53] Similarly, another systematic review indicated an increased suicide risk among individuals who received child welfare services interventions.[54]

Table 7. Characteristics of studies relating to early childhood development.

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Richard-Devantoy et al., 2023[58] Meta-analysis	To examine the association between childhood cognitive skills and adult suicidal behavior (namely, attempt and death)	General population, military conscripts	16 (11 in meta-analysis)	Population-based longitudinal studies	2008-2021	High income: Sweden, Scotland, Norway, United Kingdom, Israel	Findings indicate that low childhood cognitive skills are associated with increased risk of suicide. Educational attainment was a mediator for this association. All studies were of moderate to high quality.
Batty et al., 2022[53] Meta-analysis	To synthesize evidence on the risk of adult mortality in people with a history of state care in early life and assess the association according to different contexts	Children in state care	4	Prospective cohort	1995-2018	High income: Canada, Finland, Sweden	Adults exposed to any form of state care in childhood have more than 3 times the risk of suicide in adult compared with their unexposed counterparts. One study was of high quality; the remaining 3 were low quality.
Orri et al., 2019[55] Meta-analysis	To investigate in utero and perinatal exposures associated with suicide, suicide attempt, and suicidal ideation	General population	14	Cohort	2001-2018	Taiwan, New Zealand Upper-middle income: Brazil Varied: Europe, North America	Family/parental characteristics, including having a young mother, single-mother household, and low maternal and paternal education, were associated with higher suicide risk. The authors report the methodological quality of the included studies was high.
Vidal-Ribas et al., 2022[57] Systematic review	To synthesize evidence on early-life vulnerability to suicide beginning in the prenatal period and extending through age 12 years	Children aged ≤12 years	54	Cohort, nested case-control, case-control	Not reported	High income: Finland; Sweden; Greenland; Norway; Scotland; Taiwan; England; United States; Denmark; United Kingdom; Quebec, Canada; Copenhagen, Switzerland	13 studies found that children of mothers <20 years old had up to a 2.5-fold higher risk of suicide than children of mothers in their late 20s. 4 studies did not find an association of younger maternal age with child suicide risk. 4 studies found children of parents with lower education level had 50% higher suicide risk. 7 studies examining parental occupation and income did not find a correlation with suicide risk, except for 1 large cohort, in which lower-skilled parental occupation was associated with higher suicide risk. 4 studies found immigrant status was associated with higher suicide risk. Risk of bias in the included studies was low.

(Continued)

Table 7. Continued

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Milde et al., 2021[54] Systematic review	To gain updated knowledge on how children and youth who have received or are receiving Child Welfare Service interventions from the Nordic Child Welfare Service fare in relation to suicidality	Children in Nordic Child Welfare Services	5	Cohort	2003-2018	High income: Sweden, Finland	All 5 of the included articles indicated an increased suicide risk for individuals who have received child welfare services interventions. The quality of the included articles was not reported.
Galobardes, Lynch, and Davey Smith, 2004[56] Systematic review	To examine individual-level studies examining childhood socioeconomic circumstances and adult overall and cause-specific mortality	Adults aged ≥18 years	2	Cohort	1998 and 2003	High income: United Kingdom, Finland	Two studies reported separately on associations of childhood SES with risk of suicide in adulthood. Despite only 11 suicides occurring in the 1946 United Kingdom birth cohort, suicide was more likely among those with lower childhood socioeconomic backgrounds. In the Finnish cohort, men whose fathers worked in manual occupations had a higher risk of suicide death; this was accounted for by adult SES. Parental social class was not associated with suicide in women. Risk of bias for the included studies was not assessed.

Abbreviation: SES, socioeconomic status.

Two reviews found an association between young parent age at birth (<20 years) and education and the risk of suicide.[55,57] In another review, perinatal exposures, such living in single-mother household and low maternal socioeconomic status, were associated with higher suicide risk.[55] Another review reported an association between childhood socioeconomic position and risk of suicide in adulthood, with suicide being more likely to occur among those of lower childhood socioeconomic background.[56] Similarly, men whose fathers worked in manual occupations were also at an increased risk; however, this was accounted for by adult socioeconomic position.[56] In contrast, another review did not find an association between suicide risk and unskilled parental occupation.[57]

Finally, a meta-analysis of 11 studies indicated that low childhood cognitive skills (eg, low IQ and school performance) were associated with increased risk of suicide, mediated by educational attainment.[58]

Social inclusion and nondiscrimination

Three systematic reviews explored the relationship between social inclusion and suicide mortality (Table 8).[59-61] The majority of evidence came from high-income or upper-middle-income countries; however, there were 2 lower-middle-income countries included. One systematic review presented mixed results on the association between social capital and suicide, with only 1 of the included studies reporting an association.[59] Another systematic review examining the literature on social factors influencing suicidal behavior in older adults found that limited social connectedness was linked to suicide in later stages of life, whereas living with children was associated with a reduced risk of death by suicide.[60] Finally, in their 2023 systematic review, Blázquez-Fernández et al.[61] demonstrated a positive and direct relationship between suicide mortality and social isolation and loneliness.

Discussion

This umbrella review of 49 reviews, representing 7 (of 10) distinct social determinant domains, examined a wide range of associations with suicide risk. Overall, there was evidence of a modest effect of social determinants on suicide mortality. In particular, suicide risk was associated with unemployment and job insecurity, income, and social protection. In addition, a risk between childhood adversity—particularly experiences of care—and suicide was found. The quality of the included reviews varied considerably, as did the strength of the associations reported in the included meta-analyses. High-quality research that fully explores the relationship between social and environmental factors and suicide risk is needed.

The findings of this review support previous research that identified a direct association between economic instability and suicide, at both individual and ecological levels. Our review also clearly evidences the effects of economic recessions on suicide incidence, again reflecting previous research on this topic.[62-64] The finding that suicide rates are positively influenced by governmental measures to protect income but increase after the imposition of austerity measures[26] clearly shows the impact of governmental economic policies on suicide prevention.[65] This could include initiatives such as increased unemployment benefits, welfare programs, or stimulus packages aimed at supporting individuals and families facing financial hardship.[66] On the other hand, the imposition of austerity measures, which typically involve reductions in government spending and availability of social services, tends to exacerbate economic distress and may increase suicidal risk.[67,68] Strategies that aim to support vulnerable groups (eg, those at risk of job losses or bankruptcy) during periods of uncertainty and economic and global crises should be implemented.[69,70] Research should consider how impacts differ according to income status of countries.[71]

At an individual level, there are well-established links between social and health inequalities and suicide risk,[72,73] with emerging evidence for the role of several factors, including physical health, sociodemographic factors, early childhood events, and interactions with the criminal justice system.[73] In our review, we found that exposure to childhood adversity, represented by involvement with child welfare services and state care, conferred an increased risk of suicide in adulthood. This was also reflected in studies that examined childhood and parental socioeconomic status. This evidence adds to an increasing body of literature that indicates the need for more upstream approaches to preventing suicide, particularly those that involve primary prevention efforts targeted at young people and families.[74]

Most of the included studies ($n = 21$) focused on the relationship between environmental factors and suicide, most often, air temperature and pollution, and natural disasters. Although the evidence linking these environmental factors to suicide risk was generally weaker and suffered in terms of methodological quality, it underscores an emerging area of concern, namely, the impact of climate change on mental health. Given alarming trends in global temperatures and the increased frequency of natural disasters, understanding the mental health consequences of these environmental changes becomes increasingly important in prevention efforts.[75,76]

A challenge with evidencing the role of social determinants on health outcomes is their distal relationship, along with the complex interplay between intermediary factors,[77] and this may be one reason why the effects observed in this umbrella review are of moderate association. In particular, the association between social determinants and suicide may operate through a range of risk factors, such as substance misuse, relationship difficulties, and poor mental and physical health.[3,78,79] Findings from this review underscore the importance of longitudinal and high-quality research to disentangle the complexity of interactions between various social determinants and suicide risk. Many of the included studies in each systematic review were cross-sectional in design, limiting the ability to infer causality. Future research should use longitudinal designs and robust methodologies, including data from multiple sources, to improve understanding of the temporal relationships and potential causal pathways between social determinants and suicide.[77]

The findings of this review are consistent with those of other reviews examining social determinants of mental health more broadly. In particular, we note a recent evidence review in which the authors hypothesized that inequalities experienced at multiple levels arise via structural processes and policies that further marginalize vulnerable groups and place them at a significant disadvantage in society.[80] In addition, a recent systematic review of reviews[81] provides evidence to support a range of interventions to reduce the impact of social determinants of mental health, especially interventions targeting intimate-partner violence and programs to address working conditions and unemployment. The authors argue for a move away from traditional Western psychosocial approaches toward strategies that reduce the impacts of social determinants, such as climate action and food security, in the context of natural disasters.[81] We would argue that multilevel approaches to suicide prevention are needed, underpinned by a broader public health, whole-of-government strategy.[82] Similarly,

Table 8. Characteristics of studies relating to social inclusion and nondiscrimination.

Review	Aim	Populations of interest	No. of studies related to suicide mortality	Types of included studies	Year range of included studies	Countries included	Main findings
Blázquez-Fernández et al., 2023[61] Systematic review	To identify an updated association between isolation and suicides	Mixed (general population, children, adults aged >18 years, adolescents)	8	Cohort, case-control, cross-sectional, case-series	2016-2022	High income: South Korea, United Kingdom, United States, China Upper-middle income: Mauritius Lower-middle income: Swaziland, El Salvador	5 studies reported a positive relationship between social isolation and suicides. 8 studies indicated loneliness increased the likelihood of suicide. The quality of these studies was not reported.
Fässberg et al., 2012[60] Systematic review	To conduct a systematic analysis of studies with comparison groups that examined the associations between social factors and suicidal behavior (including ideation, nonfatal suicidal behavior, or deaths) among individuals aged ≥65 years	Adults aged ≥65 years	3 (with 4 publications)	Clinical, psychological autopsy, nested-clinical, population-based	2001-2005	High income: United States, Sweden, Hong Kong	Limited social connectedness was associated with suicide in later life. Based on 1 study, living with children was associated with decreased risk for death by suicide. Findings from 2 studies on residential change over the past 2 years found no association with suicide. The quality of these studies was not reported.
De Silva et al., 2005[59] Systematic review	To systematically review quantitative studies examining the association between social capital and mental illness	General population	3	Ecological, longitudinal	2003	High income: United States	1 study reported a higher risk of suicide in areas with higher structural social capital (unpublished data), whereas the other 2 reported no association. The authors report that methodological limitations were evaluated, documented, and presented as part of the review. Authors report all studies had methodological limitations.

a study that examined how potential drivers of national suicide rates changed over 20 years showed that the unemployment rate and the average years of schooling for women were linked to higher rates of suicide mortality, consistent with the findings of this review.[83]

Implications for policy, practice, and research

The growing recognition of the need to consider the intersectionality between social determinants of health and suicide must be reflected in the development of suicide prevention strategies. In addition, the impact of governmental policies across several sectors should consider the potential mental health impact of such policies, through the use of mental health impact assessments, for example.[72,73] It is also important that researchers consider which policies and policy settings are likely to be the most impactful and cost-effective in terms of reducing suicide at the population level.

The observed association between factors rooted in childhood experiences and environments and suicide risk has significant implications, further emphasizing the importance of prioritizing strategies to reduce suicidal risk among young people, particularly those focused on clinical, educational, and community settings.[84,85] This also has implications for the structure and delivery of health care supports and services. The findings of this review underline the need to adequately design and deliver supports and interventions for people at risk of suicide that are culturally sensitive and trauma-informed.[86]

Our review did not identify any systematic reviews that examined the impact between access to affordable health care and suicide risk. However, it is well established that long-standing challenges exist in ensuring that health services, in particular mental health services, are equally accessible across groups.[87] These challenges include addressing barriers such as stigma, acceptability, and integration of health services.[87]

Strengths and limitations

In this umbrella review, we used a robust methodology to identify evidence supporting the association between various social determinants and risk of suicide. The classification of social determinants developed by the World Health Organization (WHO)[1] provides a theoretical underpinning of the search process used in the review. The methodological rigor of the review process enhances the reliability and validity of the findings.

There are several factors to consider when interpreting the findings of this review. This review has highlighted the need for more high-quality studies examining the social determinants of suicide mortality. Significant heterogeneity was observed in the exposures examined, even within specific categories of determinants. Furthermore, many social determinants were not represented in this review. Challenges have been highlighted when considering the evidence for social determinants of health more broadly,[77] underlying the need for high-quality data. This is particularly true when examining suicide, a relatively rare outcome with well-established challenges to accurate reporting across different countries.[88]

Some primary studies are included in multiple systematic reviews and meta-analyses in this umbrella review, particularly those focusing on air pollution and temperature. This may lead to potential biases in the overview if these studies disproportionately influence results. Additionally, we observed substantial heterogeneity in the study populations and range of indicators used, ruling out the feasibility of undertaking a meta-analysis. Instead, we opted for a narrative approach to synthesize and interpret the findings from each review, allowing for a comprehensive exploration of the topic while acknowledging the diversity of evidence within the literature. Moreover, the quality of the included systematic reviews and meta-analyses also varied in the rigor of their methodology, risk of bias assessments, and reporting standards. Therefore, it is imperative to consider the quality and reliability of each included review when interpreting the findings presented here. Most of the reviews we included were rated for quality as being critically low ($n = 25$) or low ($n = 13$), particularly those focusing on the domain of the environment. This raises concerns regarding the robustness and reliability of the findings, necessitating cautious interpretation and consideration of the potential for bias and methodological weaknesses.

Although the WHO framework of social determinants provided a useful heuristic for this review, it may not encompass all relevant social determinants that contribute to suicide mortality across different populations and contexts. We were also unable to find operational definitions of the WHO concepts, which had repercussions for the development of the search terms for the review. There is a need for a more expansive and inclusive conceptualization of social determinants that considers additional dimensions, such as cultural factors, interpersonal relationships, violence, and crime. Considering these limitations, it becomes evident that more research is essential to address the gaps and challenges identified in this umbrella review and to further our understanding of the complex interplay between a wide and varying array of social determinants and their influence on suicide mortality. Similarly, there is a need to consider how social determinants vary according to region, for example, between low- and high-income countries. Because of inconsistency in the reporting of the source of primary studies and because most reviews were focused on data from high-income countries, we were unable to formally examine these differences. Although we would have liked to explore the differences and similarities in the association between income levels and social determinants of suicide, we were unable to do so, due to inconsistencies in reporting across studies. Some studies reported the region, others specified the country, and some did not provide country-level information at all.

Conclusion

This review highlights the need for high-quality research addressing the long-term associations between social determinants of health and suicide, with few studies rigorously addressing determinants such as environmental impacts, food security, structural conflict, and access to health care. Nevertheless, there was evidence for a range of determinants related to income, social protection, unemployment, and early childhood development. These findings emphasize the need to advocate for measures that implement population-based approaches to suicide prevention and enable us to better understand the impacts of measures that address social determinants in terms of mental health and suicide prevention.

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Supplementary material

Supplementary material is available at the *American Journal of Epidemiologic Reviews* online.

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Conflict of interest

The authors declare no conflicts of interest.

Data availability

This study is a systematic review and does not involve the generation or analysis of primary data. All data used in this review were obtained from published literature cited in the manuscript.

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