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Review article

Pathways to connection: Mapping the impact of social connection interventions on depression outcomes – an umbrella review

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ABSTRACT

Introduction: Social connection (SC) encompasses multiple dimensions, including structural and functional aspects of social relationships. While substantial evidence highlights the relationship between different SC metrics and depression, the effectiveness of interventions aimed at enhancing SC to alleviate depressive symptoms remains inadequately understood.

Objectives: This umbrella review combines evidence from systematic reviews to evaluate the effectiveness of SC interventions in alleviating depression. It specifically examines interventions that strengthen natural social networks, while excluding formal health-based interventions - such as psychosocial or psychotherapeutic treatments - designed to enhance social skills or deliver formal or semi-formal support within healthcare settings.

Methods: This review synthesizes the consistency and the extent of the impact of SC interventions on depression. PubMed, Cochrane Library, EMBASE, and PsycINFO were searched, resulting in the inclusion of 12 systematic reviews/meta-analyses. AMSTAR-2 and GRADE instruments were used to assess the quality and certainty of the evidence reviewed.

Results: Interventions were grouped into three categories: i) Social network and support interventions; ii) Social engagement interventions; iii) Social inclusion interventions. Findings were mixed, with some interventions demonstrating minimal/no effect compared to usual care. Interventions addressing social disengagement and promoting social integration for older individuals and psychiatric patients showed substantial improvements in outcomes. Social inclusion interventions aimed at strengthening group identification in adolescents and young adults also showed positive outcomes.

Conclusions: SC is a key determinant of depression. Further examination of targeted interventions is needed to determine which are most effective in influencing the evolving psychopathology of depressive trajectories. This may help identify targeted interventions for those at risk, thereby informing and guiding public health policies.

1. Introduction

Depression is a significant public health challenge and a leading cause of disability worldwide, manifesting across a spectrum ranging from major depressive episodes to milder, subthreshold forms that significantly impact quality of life. This diversity underscores the need

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for comprehensive strategies to mitigate risk across all levels of severity, including interventions that address not just the biological and psychological aspects of depression but also its social dimensions. Emerging evidence highlights the importance of interventions that actively engage these social dimensions to complement traditional approaches, in both preventive and therapeutic contexts (Alvarez et al., 2025).

Recent research has increasingly recognized social connection (SC) as a major modifiable determinant of depression, with both its structural and functional dimensions crucially influencing depressive trajectories (Wickramaratne et al., 2022). Structural aspects, such as the size and frequency of social interactions, essentially define the 'architecture' of our social networks, laying the foundation for potential supportive interactions. Functional characteristics focus on the quality of social interactions, particularly the supportive and emotional transactions within this framework, which directly enhance the sense of belonging and emotional well-being.

While there is growing evidence of a correlation between strong SCs and reduced vulnerability to depression (De Risio et al., 2024), the efficacy of interventions designed to strengthen social ties remains underexplored. This gap is particularly evident for interventions focused on naturally developing social networks, rather than structured therapeutic or skill-building approaches.

Existing intervention studies have primarily targeted SC in populations at elevated risk for social isolation (i.e., older adults and individuals with mental health conditions; Beckers et al., 2023; Brooks et al., 2022; Fakoya et al., 2020). However, relatively few studies have evaluated both SC and depression outcomes simultaneously, and even fewer have examined the durability of effects over time. Group-based or peer-mediated socialization programs, as well as initiatives aimed at strengthening contact between nursing home residents and family members, have shown promise in improving both SC and depressive symptoms (Franck et al., 2016; Sheridan et al., 2015; Tsai and Tsai, 2011).

While some progress has been made in these at-risk groups, studies involving the general population remain scarce. Promising interventions have emerged for younger individuals, particularly through school-based and online programs designed to enhance SC and prevent depression (Alvarez et al., 2025; Filia et al., 2021). Although many of these interventions report positive effects on SC outcomes, pooled analyses frequently fail to show statistically significant effects on depression, and most studies are rated as having some or moderate risk of bias (Alvarez et al., 2025).

This umbrella review builds on our previous work (De Risio et al., 2024) by offering an integrated synthesis of the current evidence on SC interventions and their impact on depressive outcomes, without restrictions by population or geographic region. In doing so, it identifies areas of both evidence strength and persistent knowledge gaps, with the goal of informing future intervention design, research priorities, and policy development.

The understanding of SC has evolved significantly, recognizing the complexities of shifting societal dynamics and digital interactions as natural extensions of our social transactions (Nowland et al., 2018). This evolution has shaped the development of interventions aiming to enhance these connections. SC interventions encompass a variety of activities or strategies designed to strengthen the quality and quantity of social interactions and ties.

In this review, we focus on interventions that directly target the natural social network, as opposed to indirect interventions - such as psychosocial, skill-building, or psychotherapeutic treatments - that rely on structured models and professional facilitation (e.g., Cognitive Behavioral Therapy, CBT). This choice reflects both conceptual and methodological considerations. Including interventions grounded in predefined therapeutic frameworks would have introduced substantial heterogeneity, potentially obscuring the specific effects of SC itself. Conceptually, our interest lies in the therapeutic potential of SCs as they emerge spontaneously within everyday life, those that are not externally constructed or clinically mediated. Methodologically, structured psychotherapeutic or skill-building interventions vary widely in theoretical orientation, mechanisms of action, and delivery context, making it difficult to isolate the unique contribution of SC. By focusing exclusively on interventions that amplify existing ties and catalyze new ones within a person's immediate social milieu we aim to clarify the specific effects of naturally embedded SC interventions on depression. This focused scope enhances interpretability and supports the development of public health strategies that harness everyday social environments as therapeutic resources. In this context, we also included interventions addressing stigma, discrimination, or bullying, particularly among adolescents, as these experiences can undermine perceived social safety, belonging, and access to supportive networks, thereby compromising critical aspects of SC relevant to depression.

To reflect these considerations and systematically explore these dynamics, interventions were categorized into three focused areas:

1. *Social network and social support interventions*: These aim to reduce social isolation by enhancing personal social networks and support systems, leveraging existing relationships to improve mental health outcomes.
2. *Social engagement interventions*: These are designed to improve social and community participation, encouraging people to engage in activities that promote interactions within society and enhance integration into social groups.
3. *Social inclusion interventions*: These focus on combating social inequalities—systematic disparities and imbalances in access to resources and opportunities across social groups—, enhancing opportunities for participation in social and community activities, particularly for disadvantaged groups, as those facing social, economic, or structural barriers limiting their inclusion.

This categorization reflects the multifaceted nature of SC and captures the main ways these connections are strengthened through targeted interventions. It aligns with the current understanding of how SCs influence depressive outcomes, providing a clear framework to assess the impact of these interventions.

From a theoretical standpoint, interventions designed to enhance social network and support are grounded in theories like the stress-buffering model, which posits that social support can buffer the effects of stress and mitigate its impact on depression (Cohen and Wills, 1985). Similarly, engagement interventions are supported by community integration theories, which suggest that active participation in social and community life can enhance mental health by building protective social networks (Samuel et al., 2014). Inclusion interventions are informed by theories of social capital and equity, which highlight the role of inclusivity and access to resources in promoting mental health and are based on the premise that social exclusion can be a significant driver of depression (Eisenberger et al., 2003).

This umbrella review aims to systematically assess the effectiveness of these categorized interventions in reducing depressive symptoms. By integrating evidence from systematic reviews and meta-analyses, we aim to offer insights into how SC interventions can be effectively operationalized to mitigate depression across various populations and settings. Additionally, we will assess the effects of these interventions on SC outcomes, aiming to uncover which aspects of SC are most responsive to intervention efforts. This synthesis is intended to guide future research, inform the development of targeted, effective interventions, and support public health strategies and clinical practice in addressing the multifaceted nature of depression.

2. Materials and methods

2.1. Protocol

We applied an umbrella review approach (a systematic 'review of

reviews'; Belbasis et al., 2022) compiling evidence from multiple reviews and meta-analyses on the impact of interventions/programs targeting various measures of social connection (SC) on depression. This review was conducted in accordance with the PRISMA 2020 framework (Page et al., 2021; **Supplementary Table S1**). The protocol was registered in PROSPERO registry (registration number: CRD42023478548).

2.2. Social connection definition

SC represents an umbrella term capturing "the multiple ways in which individuals connect to others emotionally, behaviourally, and physically" (Holt-Lunstad, 2018, p. 440). The term includes constructs and measurement approaches related to both the structural–quantitative (i.e., presence/absence of social relations and their structure) and the functional–qualitative (resources that relationships provide, i.e., support) dimension of social relations.

2.3. Search strategy

We conducted a search of PubMed/MEDLINE, EMBASE, PsycINFO, and the COCHRANE Library from their inception to 21 August 2023 for systematic reviews and meta-analyses of intervention studies investigating the impact of SC interventions on depression. Reference lists of relevant reviews were manually searched. The search strategy was aimed at capturing various aspects of social relationships (quantitative/structural, functional/qualitative) representing potential target of interventions (see **Supplementary material** for full search strategy).

2.4. Study selection

Any systematic review of intervention studies synthesising evidence regarding the impact of interventions/programs targeting various measures of SC on depression and depressive symptoms was included. *SC Interventions* were defined as those aimed at promoting/enabling SC by directly targeting the natural social network, as opposed to indirect interventions (such as psychosocial or psychotherapeutic treatments) that primarily aim to improve social skills or adopt specific theoretical models (e.g., Cognitive Behavioural Therapy, psychoeducation and treatments having as a scope the improvement in social skills/competence, such as Interpersonal Psychotherapy) (see **Supplementary material** for further details on study selection). As part of our eligibility criteria, we also included reviews of interventions addressing stigma, discrimination, and bullying, provided these were conceptually linked to SC or its disruption. This decision was informed by evidence suggesting that such experiences can significantly compromise an individual's ability to form or sustain supportive social ties, particularly in populations at risk for depression.

Reviews were excluded based on the following criteria: (1) they were not written in English; (2) they were not full-text articles; (3) they were not systematic reviews or were protocols of systematic reviews or umbrella reviews; (4) they were earlier versions of systematic reviews when a more recent updated version was available; (5) they did not focus on reviews of intervention studies; (6) they examined interventions other than SC interventions (see section *Intervention/Exposure*) or they lacked sufficient detail to determine whether the interventions reviewed qualified as SC interventions; (7) they did not include a separate synthesis, based on at least two primary studies, evaluating the effectiveness of SC interventions on depression compared to a control group.

Each article was screened independently by two reviewers, with any discrepancies resolved through consultation with a senior reviewer.

2.5. Data extraction

The following categories of data were extracted (with further details provided in **Supplementary material**): (i) bibliographic information; (ii) evidence reviewed (search methods); (iii) evidence reviewed (inclusion and exclusion criteria); (iv) intervention characteristics (from both systemic reviews/meta-analyses and primary studies); (v) outcome measures; (vi) effectiveness of the intervention (descriptive and quantitative results); (vii) additional data: references of primary studies for subsequent calculation of the overlap among included studies in different reviews (**Supplementary material**). Data extraction from the included studies was conducted independently by two reviewers, with any discrepancies resolved through consultation with a senior reviewer.

2.6. Quality evaluation and certainty of the evidence reviewed

AMSTAR-2 tool was used to evaluate the quality of the included systematic reviews (Shea et al., 2017). The certainty of the effect in the meta-analyses was evaluated using GRADE framework (Schünemann et al., 2013). Additional details can be found in the **Supplementary material**.

2.7. Measures of effect and strategy for data synthesis

Primary outcome: depression diagnosis and severity of depressive symptoms assessed through clinician-rated scales/interviews and self-report scales.

Secondary outcome: SC scores. This secondary outcome was included to assess: (i) the extent to which the interventions enhanced SC within the target population; and (ii) whether increases in SC were associated with reductions in depressive symptoms, potentially acting as mediators of the interventions' effectiveness.

Systematic reviews with meta-analysis: effect sizes (i.e., overall impact of interventions on outcomes) were extracted from the included meta-analyses, along with the corresponding 95 % confidence interval (CI). Pooled effect measures were taken as originally reported in individual meta-analyses and included Mean Difference (MD) and Standardized Mean Difference (SMD), including Hedges' g. To facilitate comparisons of direction and magnitude of effect sizes across meta-analyses using different metrics, all effect sizes were converted into equivalent Odds Ratio (eOR) using established methods for effect sizes transformation (Borenstein et al., 2009; Murad et al., 2019; Polanin and Snilstveit, 2016). Cohen's *d* thresholds (0.2, 0.5, and 0.8) were used as references to classify effect sizes as weak, moderate, and strong, respectively; these thresholds correspond to eORs of 1.44, 2.48, and 4.27 (with corresponding eORs of 0.69, 0.40, 0.23 indicating effects in the opposite direction, i.e., protective effects).

Systematic reviews without meta-analysis: evidence on the effectiveness of SC interventions on outcomes was narratively synthesized. Data were summarized as the number of studies reporting a "positive effect" (i.e., a statistically significant reduction in depressive symptoms or a significant increase in SC scores compared to a control group) out of the total number of studies reviewed. The quality of synthesis in each included review was also considered, based on AMSTAR-2 scores.

3. Results

3.1. Selection of included reviews

The database searches yielded 2688 results. After record removal prior to screening, 1535 records were screened based on their titles and abstracts. Of these 1318 were excluded, leaving 216 for full-text screening. Ultimately, 11 articles were included in the final review. Of the 28 records identified by the manual search, one was included. The final sample consisted of 12 articles, of which eight provided quantitative syntheses/meta-analyses (Giebel et al., 2022; Guzman-Holst et al., 2022; Hunt et al., 2023; Lu et al., 2022; Noone et al., 2020; Purcell et al., 2023; Steffens et al., 2021; Yan et al., 2021), while the remaining four provided narrative syntheses (Eysenbach et al., 2004; Ma et al., 2020; Ronzi et al., 2018; Zhong et al., 2020). Detailed selection process is shown in Fig. 1. A list of studies excluded after full-text revision is

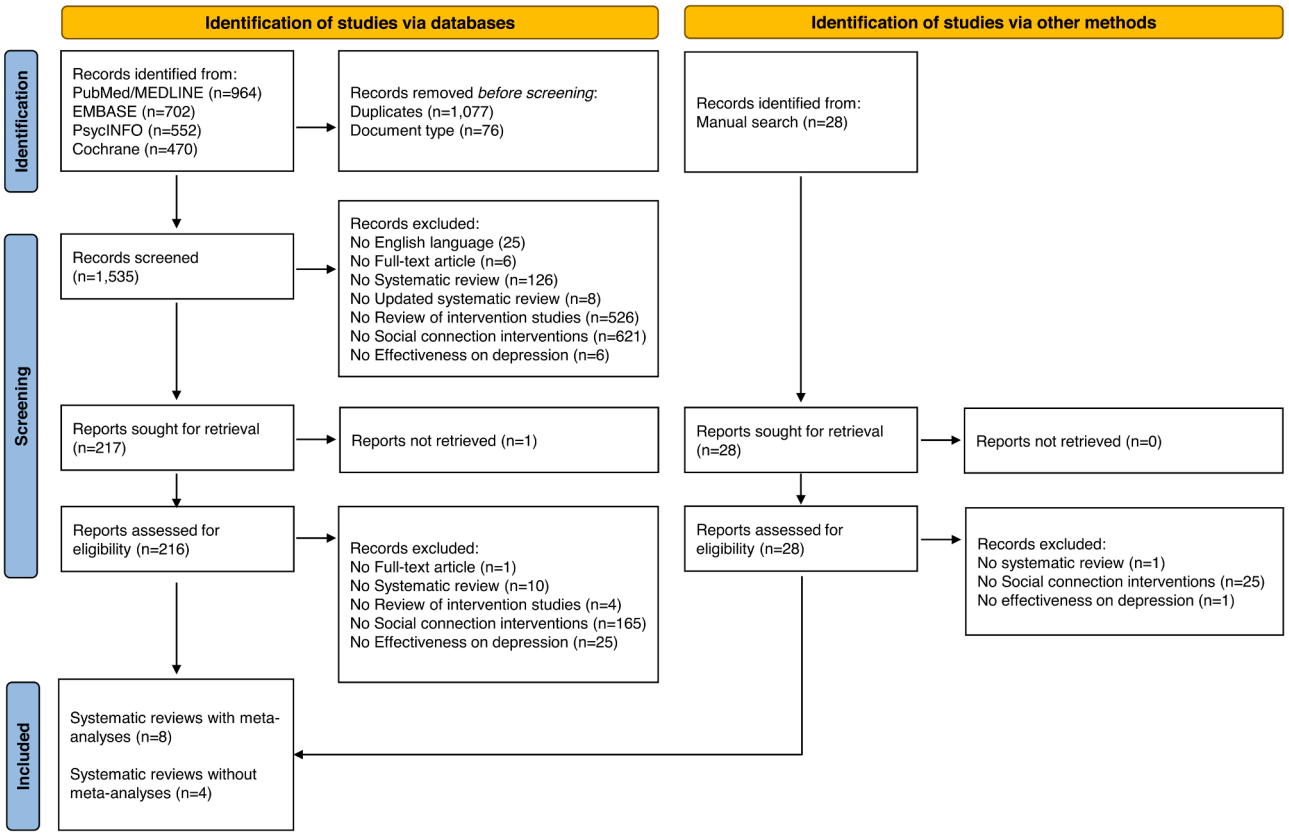

Fig. 1. Flow chart of the study selection process.

reported in **Supplementary Table S2**.

3.2. Characteristics of included reviews/meta-analyses

3.2.1. Evidence reviewed

Supplementary Tables S3–S4 report the detailed characteristics of the included reviews/meta-analyses. All reviews/meta-analyses were published between 2004 and 2023 (with 10 out of 12 very recent reviews published between 2020 and 2023). In the majority of the reviews (8/12) the effectiveness of interventions on depression was investigated within the general population (2/12 no limits, 4/12 older adults, 2/12 children and adolescents), while 2/12 focused on clinical populations (a review focused on adults with heart disease, the other on older individuals with dementia) and 2/12 studies focused on people with mental health conditions (depression, anxiety, post-traumatic, schizophrenia, bipolar disorders). Most of the included reviews (9/12) did not restrict the inclusion of primary studies based on geographic location. In contrast, 3/12 reviews applied geographic limitations in their inclusion criteria: one focused exclusively on low- and middle-income countries, another included only studies conducted in China, and a third was limited to studies from the United States.

3.2.2. Social connection interventions

Social connection (SC) interventions were categorized as follows: a) Social network and Social support interventions (4 out of 12 included reviews/meta-analyses); b) Social engagement interventions (5/12 reviews/meta-analyses); c) Social inclusion interventions (3/12 reviews/meta-analyses). **Supplementary Table S5** provides a detailed description of interventions reviewed, while **Supplementary Table S6** describes intervention characteristics at the level of primary studies.

Two meta-analyses (Noone et al., 2020; Purcell et al., 2023) and two systematic reviews (Eysenbach et al., 2004; Ma et al., 2020) evaluated the impact of *Social network and support interventions* on depression compared to usual care, waitlists, other interventions, or no interventions. Purcell et al. focused on app- or social media-based interventions for people with heart disease, leveraging relationships with caregivers, peers, or family to reduce social isolation and improve connectedness. Similarly, Noone et al. reviewed internet-based interventions (e.g., video calls) for older adults to alleviate loneliness or isolation. Eysenbach et al. examined virtual communities where individuals with shared health interests interact via computer-based tools. Ma et al.'s review included diverse interventions such as supported socialization, psychoeducation, cognitive change, and community approaches.

Three meta-analyses (Giebel et al., 2022; Lu et al., 2022; Yan et al., 2021) and two systematic reviews (Ronzi et al., 2018; Zhong et al., 2020) evaluated *Social engagement interventions* promoting community participation on depression compared to usual care, other interventions, or no interventions. Four studies focused on intergenerational programs for older adults, fostering interactions between nonfamily members across generations to enhance social inclusion, community belonging, and participation in activities. Yan et al. analysed the clubhouse model of psychiatric rehabilitation, engaging individuals with severe mental illness in social events, work, and housing to build networks and community belonging.

Three meta-analyses (Guzman-Holst et al., 2022; Hunt et al., 2023; Steffens et al., 2021) examined *Social inclusion interventions* on depression compared to no interventions. Guzman-Holst et al. focused on school-based antibullying programs targeting policies, behaviors, and training for families and teachers. Steffens et al. reviewed interventions enhancing group identification through shared activities, reflective practices, or psychoeducational approaches. Hunt et al. synthesized evidence on social inclusion interventions for adolescents, including community mentorship, life skills training, belonging initiatives, and educational programs addressing poverty and school enrolment.

3.2.3. Social connection measures

Of the 12 reviews included, eight (4 meta-analyses, 4 systematic reviews) evaluated the impact of interventions on various SC measures, including social support, loneliness, social disengagement, social engagement (passive, active and self-engagement), social identification, social isolation (subjective and objective), and social interactions. Not all reviews specified the measures used to assess SC in the primary studies. When reported, a broad range of instruments were employed to evaluate these social measures, as shown in **Supplementary Table S7**.

3.2.4. Quality/Certainty of evidence

The quality of included reviews was assessed as critically low (2/12), low (4/12), moderate (4/12) or high (2/12) using AMSTAR-2 tool (**Supplementary Table S8**). According to GRADE, certainty of evidence for the outcome depression was rated as low (1/8), moderate (3/8) or high (4/8) (**Supplementary Table S9**) and as low (3/7), moderate (1/7) or high (3/7) for the outcome SC (**Supplementary Table S10**).

3.3. Effectiveness of social connection interventions on depression

All reviews assessed the effectiveness of SC interventions on depression (inclusion criterion) (8 provided a quantitative synthesis/meta-analysis, 4 provided a qualitative synthesis).

3.3.1. Quantitative synthesis

Fig. 2 provides an overview of the impact of SC interventions on depression, focusing on short-term outcomes (8 reviews, 8 effect sizes). Additional details and long-term outcomes (2 reviews, 2 effect sizes) are presented in **Supplementary Table S11**. One primary study was included in two reviews on the same type of SC intervention (social inclusion interventions; Hunt et al., 2023; Steffens et al., 2021), with a 6.7 % overlap. Except for two meta-analyses on social network and social support interventions, which reported negligible effects on depression (Fig. 2a), there is evidence that social engagement interventions reduce depressive symptoms across various populations (people with schizophrenia, older adults including those with dementia), with effects ranging from weak to strong (Fig. 2b). Moreover, social inclusion interventions (i.e., those promoting access to social capital and social integration) show moderate effects on depression, except for school-based antibullying interventions (Fig. 2c).

3.3.2. Qualitative synthesis

Four reviews provided a qualitative synthesis of the impact of SC interventions on depression, as summarized in Table 1. One primary study was included in two reviews on intergenerational programs (Ronzi et al., 2018; Zhong et al., 2020) with a 20.0 % overlap. Two reviews examined the impact of social network and social support interventions on depressive symptoms, showing mixed results (Table 1a). Virtual communities generally failed to reduce depressive symptoms, with only

Table 1
Effectiveness of Social Connection Interventions on depression outcomes (Qualitative synthesis).

Review included (First author year)	Target population	SC Intervention [Comparator(s)]	Summary result	Quality (AMSTAR-2)[#]
a) Social network and Social support interventions				
Eysenbach, 2004	no limits	Virtual communities [Usual care, Waitlist, Other interventions]	1/6 studies found significant positive effects	Critically Low
Ma, 2020	People with mental health conditions[*]	Social isolation interventions [Usual care; No intervention; Waitlist]	4/9 studies found significant positive effects	Low
b) Social engagement interventions				
Ronzi, 2018[§]	Older adults aged 60 years+	Intergenerational interventions [No intervention, Recreational activities]	3/3 studies found significant positive effects[**]	Moderate
Zhong, 2020[§]	Older adults aged 50 years+	Intergenerational communities [No interventions, Waitlist]	1/3 studies found significant positive effects	Moderate

Note. "positive effect": a statistically significant reduction in depressive symptoms compared to a control group;.

[#] AMSTAR-2 rating not considering item 7 (further details in **Methods** and **Table S8**).

[*] including depression, anxiety, post-traumatic disorder, psychosis/schizophrenia or bipolar disorders;.

[**] only controlled studies were considered;.

[§] Ronzi (2018) and Zhong (2020): degree of overlapping: 20.0 %.

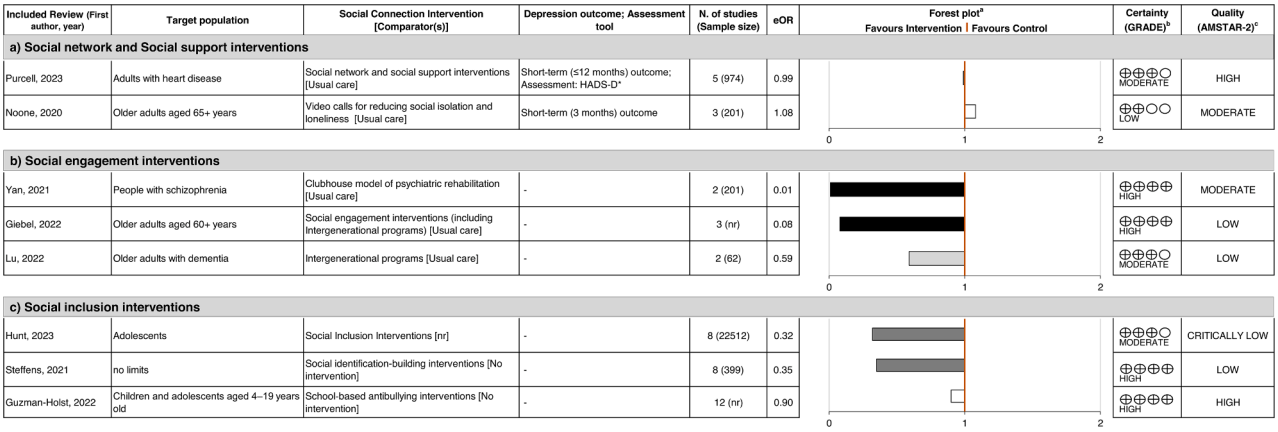

Fig. 2. Effectiveness of Social connection interventions on depression: **a)** Social network and Social support interventions; **b)** Social engagement interventions; **c)** Social inclusion interventions. *Abbreviation.* eOR=equivalent odds ratio; HADS-*D*=Hospital Anxiety and Depression Scale-Depression score. *Note.* [a]Effect size (eOR) were considered negligible (white), weak (light grey), moderate (dark grey), strong (black) (see **Methods** section for further detail). [b]The certainty in the estimates of the effect in the primary meta-analysis was assessed using GRADE (see **Methods** and **Table S9** for further details). [c]AMSTAR-2 rating was given not considering item 7 (see **Methods** and **Table S8** for further details). *Depression assessed with HADS-D is shown since this effect size is based on a larger number of subjects (effect size using PHQ-9 to assess depression is shown in **Table S11**).

one primary study reporting significant positive effects on depression (Eysenbach et al., 2004). Conversely, interventions targeting social isolation, designed to alleviate both subjective and objective social isolation (Ma et al., 2020), were effective in reducing depression in individuals with mental health conditions, with nearly half of the studies showing a reduction in symptoms. Similarly, social engagement interventions aimed at promoting community participation, such as intergenerational programs (programs fostering social interactions between non-family members from different generations by promoting cooperation and exchange; Ronzi et al., 2018; Zhong et al., 2020), have shown potential for reducing depressive symptoms in older adults (Table 1b).

3.4. Effectiveness of social connection interventions on social connection outcomes

Some of the included reviews assessed the effectiveness of SC interventions in improving SC measures (4 quantitative syntheses/meta-analyses, 4 qualitative syntheses). The SC measures assessed were: social support, loneliness, social engagement/disengagement, social identification, social isolation, social inclusion and social interactions.

3.4.1. Quantitative synthesis

An overview of the impact of SC interventions on SC measures is provided in Fig. 3 (4 reviews, 7 effect sizes) with further details shown in **Supplementary Table S12**. No primary studies were included in more than one meta-analysis on the same type of SC intervention, resulting in a 0 % overlap. Two meta-analyses investigating the effect of social network and social support interventions on SC measures (social support and loneliness) reported negligible effects (Fig. 3a). One meta-analysis by Lu and colleagues synthesized the evidence on the effect of intergenerational programs in promoting engagement and mitigating disengagement among older individuals, revealing promising results with weak to strong effects for all measures except for active engagement (Fig. 3b). Interventions aimed at enhancing participants' identification with a specific target group also demonstrate a moderate effectiveness in improving this particular SC measure (Fig. 3c).

3.4.2. Qualitative synthesis

Four reviews conducted a qualitative synthesis of the impact of SC interventions on SC measures, as summarized in Table 2. No primary studies were included in more than one review on the same type of SC intervention, resulting in a 0 % overlap. Two reviews synthesized available evidence on the impact of social network and social support interventions on social support and social isolation measures, yielding mixed results (Table 2a). Half of the studies reviewed by Eysenbach and colleagues indicate a positive effect of virtual communities in increasing social support, as assessed with a wide variety of tools (see **Supplementary Table S7**). Ma and colleagues' review was the sole synthesis of evidence on the impact of social isolation interventions on both objective and subjective SC measures, revealing that subjective assessments - capturing personal perceptions of social support - may be more resistant to change (only 2 out of 14 studies found significant positive results) compared to objective measures quantifying social contacts and network sizes (7 out of 11 studies found significant positive results) (see also **Supplementary Table S7** for the tools used). Although social engagement interventions appear capable of counteracting disengagement in the older population (see also Fig. 3), the sample of studies reviewed by Zhong and colleagues is too small to draw definite conclusions (Table 2b). Similarly, while the vast majority of studies applying social inclusion interventions found positive results (Table 2c), higher quality syntheses are needed to further explore the potential of these programs in addressing access to social capital in adolescents, ultimately promoting their social integration.

3.4.3. Moderating effect of social connection on interventions' effectiveness

In two reviews (Steffens et al., 2021; Guzman-Holst et al., 2022), changes in SC measures (social identification and bullying victimization/perpetration respectively) were hypothesized to act as mediators, potentially explaining the impact of SC interventions on depression outcomes. To assess whether interventions are more effective when they strengthen SC with the target population—suggesting that improvements in SC outcomes are associated with greater improvements in depression symptoms—Steffens and colleagues examined the relationship between the effect sizes of the interventions on social identification and health outcomes. Their findings revealed a positive association of moderate magnitude ($r = 0.33$). supporting the hypothesis that interventions are more effective when they enhance social identification with the target group.

Similarly, Guzman-Holst and colleagues examined whether reduction in bullying was able to mediate intervention effects. The analysis found no mediation effects, with no evidence of indirect effect of victimization/perpetration mediating intervention status on internalizing symptoms.

4. Discussion

Social connection (SC) has consistently emerged as a major protective factor against depression, with its absence linked to increased incidence, severity, and chronicity of depressive symptoms across the

Included Review (First author, year)	Target population	Social Connection Intervention [Comparator]	Social Connection measure	N. of studies (Sample size)	eOR	Forest plot[a] Favours Intervention | Favours Control	Certainty (GRADE)[b]	Quality (AMSTAR-2)[c]
a) Social network and Social support interventions								
Purcell, 2023	Adults with heart disease	Social network and social support interventions [Usual care]	Social support*	3 (1889)	0.90		⊕⊕⊕⊕ HIGH	HIGH
Noone, 2020	Older adults aged 65+ years	Video calls for reducing social isolation and loneliness [Usual care]	Loneliness (at 3 months)	3 (201)	0.96		⊕⊕◯◯ LOW	MODERATE
b) Social engagement interventions								
Lu, 2022	Older adults with dementia	Intergenerational programs [Usual care]	Social engagement (passive engagement)	2 (54)	0.00		⊕◯◯◯ LOW	LOW
Lu, 2022	Older adults with dementia	Intergenerational programs [Usual care]	Social disengagement	3 (102)	0.15		⊕⊕⊕⊕ HIGH	LOW
Lu, 2022	Older adults with dementia	Intergenerational programs [Usual care]	Social engagement (self-engagement)	2 (54)	0.54		⊕⊕⊕◯ MODERATE	LOW
Lu, 2022	Older adults with dementia	Intergenerational programs [Usual care]	Social engagement (active engagement)	3 (102)	1.75		⊕◯◯◯ LOW	LOW
c) Social inclusion interventions								
Steffens, 2021	no limits	Social identification-building interventions [No intervention]	Social Identification	20 (1252)	0.40		⊕⊕⊕⊕ HIGH	LOW

Fig. 3. Effectiveness of Social connection interventions on social connection outcomes: **a)** Social network and Social support interventions; **b)** Social engagement interventions; **c)** Social inclusion interventions. *Abbreviation.* eOR=equivalent odds ratio. *Note.* [a]Effect size (eOR) were considered negligible (white), weak (light grey), moderate (dark grey), strong (black) (see **Methods** section for further detail). [b]The certainty in the estimates of the effect in the primary meta-analysis was assessed using GRADE (see **Methods** and **Table S9** for further details). [c]AMSTAR-2 rating was given not considering item 7 (see **Methods** and **Table S8** for further details). *All studies assessed social support with the ENRICHD Social Support Instrument.

Table 2
Effectiveness of Social Connection Interventions on social connection outcomes (Qualitative synthesis).

Review included (First author year)	Target population	SC Intervention [Comparator(s)]	Social measure	Summary result	Quality (AMSTAR-2)[#]
a) Social network and Social support interventions					
Eysenbach, 2004	no limits	Virtual communities [Usual care, Waitlist, Other interventions]	Social support	4/8 studies found significant positive effects*	Critically Low
Ma, 2020	People with mental health conditions**	Social isolation interventions [Usual care; No intervention; Waitlist]	Subjective social isolation Objective social isolation Both	2/14 studies found significant positive effects* 7/11 studies found significant positive effects 2/4 studies found significant positive effects	Low
b) Social engagement interventions					
Zhong, 2020	Older adults aged 50 years+	Intergenerational communities [Usual care, No interventions, Other interventions]	Social interactions	1/2 studies found significant positive effects	Moderate
c) Social inclusion interventions					
Hunt, 2023[§]	Adolescents	Social Inclusion Interventions [nr]	Social inclusion	7/8 studies found significant positive effects[#]	Critically Low

Note. "positive effect": a statistically significant increase in SC scores compared to a control group;.
[#] AMSTAR-2 overall rating not considering item 7 (further details in **Methods** and **Table S8**).
[*] only controlled studies were considered;.
[**] including depression, anxiety, post-traumatic disorder, psychosis/schizophrenia or bipolar disorders.
[§] This review provided a quantitative synthesis (meta-analysis) of the effect of interventions on depression, while a qualitative synthesis was provided for the effect on social connection measures. [#]The strongest effect was evident in a study that included female participants only (Gee et al.).

lifespan (Holt-Lunstad, 2024; De Risio et al., 2024). Structural aspects of SC (i.e., social network size and frequency of contact) have been associated with lower risk for depressive episodes, while functional aspects, including perceived support and emotional closeness, have been shown to buffer against psychological distress (Wickramaratne et al., 2022). Evidence from a recent umbrella review of 47 meta-analyses indicates that high levels of social support reduce the risk of developing depression and enhance recovery both in individuals diagnosed with depression and in at-risk or general population groups (De Risio et al., 2024). Conversely, experiences of social exclusion, stigma, or discrimination can erode protective social mechanisms, contributing to the onset and persistence of depressive symptoms.

Despite this well-established association, relatively few studies have directly evaluated interventions aimed at enhancing SC as a means of alleviating depression (Alvarez et al., 2025). This umbrella review addresses that gap by synthesizing the outcomes of SC interventions across both depressive symptoms and SC-related measures, incorporating findings from 8 meta-analyses and 4 systematic reviews conducted in a wide range of populations and settings. Overall, the review presents mixed results, reflecting the inherent complexity of depressive disorders and the multifaceted nature of SC. The effectiveness of SC interventions varies significantly across different studies, depending on the type of intervention and the specific population targeted.

4.1. Methodological considerations

Our classification of SC interventions into social network and support interventions, social engagement interventions, and social inclusion interventions reflects the primary methods through which SC is enhanced. As previously noted, we deliberately excluded CBT and similar psychosocial or psychotherapeutic approaches to isolate the impact of SC itself, avoiding the confounding effects of these well-established therapeutic methods. Our inclusion criteria were intentionally focused on interventions leveraging natural social networks to reflect real-world conditions and understand the sustainable impacts of these interventions more accurately. However, this focus also meant excluding potentially effective interventions incorporating elements of structured psychotherapy, which may limit the scope of our findings. Recognizing contemporary shifts in social dynamics, we included virtual communities, considering them part of the natural social milieu. Digital platforms are integral to forming and maintaining SCs, making them crucial targets for interventions aimed at mitigating depression (Smith et al., 2023).

4.2. Effectiveness of SC interventions on depression and SC outcomes

The review presents mixed yet informative results regarding the effectiveness of SC interventions in reducing depressive symptoms and shaping SC outcomes.

Interventions directly addressing social disengagement yielded the most substantial improvements in depressive outcomes. This was particularly apparent for certain demographics, like older individuals and psychiatric patients, who seem to benefit more from interventions aimed at promoting community participation. This may be due to these groups experiencing higher rates of isolation or having fewer opportunities for social engagement (Fakoya et al., 2020).

These patterns can be more meaningfully interpreted through the theoretical frameworks that inform different types of SC interventions. The stress-buffering model (Cohen and Wills, 1985), for example, helps explain why programs that foster emotionally supportive and reciprocal relationships (such as intergenerational or peer-based initiatives) appear particularly effective in alleviating depressive symptoms: they intervene precisely at the point where stress and vulnerability intersect. Similarly, the benefits observed with social engagement interventions reflect principles from community integration theories (Samuel et al., 2014), which emphasize the structuring power of belonging and shared participation in reducing vulnerability to depression. The moderate outcomes associated with social inclusion strategies align with theories of social capital and equity (Eisenberger et al., 2003), underscoring how equitable access to collective resources can strengthen both individual agency and relational capacity. By contrast, the limited effects seen in digital or passive interventions may stem from their failure to activate these relational mechanisms, particularly when social interactions are shallow, one-sided, or disconnected from the lived realities of participants.

Intergenerational programs stand out as particularly effective in older populations, both in reducing depressive symptoms and enhancing social connectedness. Indeed, more than half of the studies within this category showed significant positive effects on SC scores. These programs likely succeed by leveraging existing social frameworks and

resources to counteract social disengagement and foster a sense of purpose and belonging among participants. These interactions likely serve a dual purpose: strengthening community ties, thereby contributing to more resilient and supportive community structures, while also reducing individual symptoms of depression. This aligns with theoretical frameworks in social psychiatry, which emphasize the therapeutic potential of leveraging resources available within communities and the natural propensity for SC (Bowlby, 1969; Cohen and Wills, 1985; Li et al., 2023). The clubhouse model of psychiatric rehabilitation, another form of social engagement, demonstrated a strong impact on depression for patients with schizophrenia. However, it is important to note that SC was not reported as an outcome in the review. As such, we are unable to draw conclusions regarding the effect of these interventions on SC. This gap underscores the need for future studies to include both depressive and SC outcomes when evaluating the impact of structured SC interventions, particularly in populations with severe psychiatric conditions. Understanding how these interventions influence not only depressive symptoms but also the architecture of social networks could provide valuable insights into more comprehensive approaches for improving both mental health and social well-being in these vulnerable groups. Tailored interventions that address the unique challenges faced by individuals with severe mental illness are essential, and further research is needed to explore the broader social impacts of these rehabilitation models.

Interventions that enhance social inclusion show moderate effects in mitigating symptoms of depression across various populations, with the exception of school-based antibullying programs, which demonstrated negligible effects on depressive outcomes. The variability in results for social inclusion interventions could be attributed to differences in intervention design, target populations, and baseline characteristics of social ties among participants, which are often not thoroughly examined. Specifically, social identification interventions showed moderate effects on both depression and SC scores, which, given the complexity of treating depressive symptoms, represent a promising outcome. These interventions appear to initiate meaningful changes in social identification, which are substantial enough to positively influence clinical outcomes, though further research is needed to explore how these effects can be maximized. For adolescents, social inclusion interventions demonstrated moderate effects on depression, with most studies reporting significant positive effects also on SC outcomes (qualitative synthesis). However, the limited impact of school-based antibullying programs on depressive outcomes suggests that these interventions may require additional components or a broader approach to effectively influence mood and social metrics. Enhancing social inclusion may improve SC outcomes, but to achieve more substantial improvements in mood, these interventions may need to be part of a broader strategy that integrates elements such as online social networking, educational settings, and family dynamics, which are critical for this demographic (Huang et al., 2023).

Social network and social support interventions aimed at reducing social isolation showed mixed results, with differences emerging between qualitative and quantitative syntheses. While some qualitative reviews reported positive effects on SC outcomes in about half of the studies, quantitative synthesis generally found negligible effects on both SC and depressive symptoms. Interventions focusing primarily on increasing social network size or employing passive forms of engagement, such as video calls or virtual communities, were less consistently effective, particularly in quantitative analyses. One possible explanation is that these modalities often lack the emotional depth, reciprocity, and contextual attunement that characterize effective in-person social support. Although virtual communities helped build social networks in about half of the qualitative studies, significantly fewer showed benefits in terms of depression. This discrepancy suggests that while online communities may enhance structural SC, they may be insufficient to affect emotional well-being without complementary supports. Moreover, among studies specifically targeting individuals with mental health conditions, fewer than half demonstrated significant positive effects on both SC and depressive symptoms. This pattern points to the likelihood that conventional interventions may not adequately address the unique relational barriers, psychosocial needs, and network disruptions common in psychiatric populations. These findings underscore the importance of developing more tailored and context-sensitive approaches, capable of adapting to the specific challenges faced by individuals with mental illness and other socially vulnerable groups.

4.3. Target populations

The review underscores a marked variability in the effectiveness of SC interventions across different age groups. For older adults, interventions fostering structured social engagement, particularly those integrating community participation or intergenerational activities, showed promising outcomes. These interventions align well with the social needs and lifestyle changes associated with aging, such as increased risk of social isolation due to physical health declines or the loss of peers (Fakoya et al., 2020).

For adolescents and young adults, social inclusion interventions demonstrated moderate effects on both depression and SC measures, with most of the studies in the qualitative synthesis reporting significant positive effects on SC. However, school-based antibullying interventions for children and adolescents showed negligible effects on depressive outcomes in quantitative analyses, and social measures were not assessed in these studies. These findings highlight a significant gap in SC intervention strategies for younger populations, particularly beyond social inclusion interventions. While social inclusion can improve SC measures, there is a clear need to broaden the scope of interventions to address other key aspects of adolescent social interaction, such as digital engagement, educational settings, and peer dynamics. This focus is particularly urgent given the rising rates of depression globally among adolescents and young adults (Yang et al., 2024), which suggests that current interventions may not fully meet the specific social needs and communication preferences of these age groups. Expanding the intervention frameworks to consider these factors could lead to more effective outcomes in both depressive symptoms and SC measures for younger demographics.

4.4. Differentiation between objective and subjective measures

The qualitative synthesis of SC measures underscores the need to better differentiate between objective and subjective dimensions of SC. Challenges in measuring these two facets, and the frequent blurring between them, complicate efforts to evaluate intervention effectiveness. Subjective assessments, which capture perceived support, belonging, or loneliness, often yield results that diverge from objective indicators such as the size, frequency, or density of social networks. This misalignment reflects the complex, psychologically mediated nature of SC, shaped by individual expectations, interpretations, and prior experiences. Discrepancies between improvements in SC measures and depressive outcomes may be partly explained by interventions that enhance the quantity of interactions (objective) without improving their perceived quality (subjective). Effective interventions may need to address both dimensions simultaneously.

Future studies should consider integrated mixed-methods designs that capture the interplay between objective and subjective SC. This could include longitudinal designs where real-time objective data (e.g., via passive sensing, wearable technology, or digital interaction logs; e.g., Janssen et al., 2024) is collected alongside periodic self-reported assessments of perceived social support, quality of interactions, or social satisfaction. Integrating these data streams may help to identify which configurations of SC (e.g., small but high-quality networks vs. large but superficial ones) are most protective against depression. Analytical techniques such as structural equation modeling or network-based mediation analysis may further clarify how subjective

and objective elements interact or mediate depressive symptoms. Additionally, digital tools such as ecological momentary assessments (EMA) and smartphone-based tracking apps could be designed to capture dynamic shifts in both types of SC in relation to mood over time. Integrating these technologies into intervention studies would enhance ecological validity, improve sensitivity to change, and support the development of more personalized intervention strategies that target both the structure and the meaning of social ties.

4.5. Limitations

The varying quality of the included reviews presents significant challenges. Moreover, many studies lack rigorous design and longitudinal follow-up, which are essential for assessing the certainty and durability of observed effects. A major limitation lies in the substantial heterogeneity in how both depression and SC were defined and measured across primary studies. In particular, the absence of standardized, widely accepted definitions and measurement tools for SC represents a key source of conceptual and methodological variability. This inconsistency likely impacted the comparability of findings across studies and may have undermined the internal coherence and validity of some of the meta-analytic syntheses.

This umbrella review is based on a qualitative comparison of overall effect sizes reported in existing meta-analyses. As such, we did not perform formal statistical analyses of heterogeneity or publication bias, which would require access to individual study-level data. Differences in study populations, intervention formats, outcome measures, settings, and reporting conventions likely contributed to the wide variability in effect sizes (ranging from negligible to strong; see Figs. 2–3). In addition, the potential influence of publication bias (such as the preferential publication of studies with positive or statistically significant results) cannot be ruled out.

These limitations highlight the need for future umbrella reviews with access to primary data, enabling more robust analyses of heterogeneity and bias. They also underscore the urgency of developing consensus-based, psychometrically sound measures of SC, which would enhance the consistency, interpretability, and cumulative value of research in this field.

5. Conclusion and future directions

This umbrella review highlights the promising role of SC interventions in mitigating depressive symptoms, while identifying critical gaps in evidence and implementation. The relationship between enhanced SC and reduced depression is complex, shaped by the type of intervention, the characteristics of the target population, and the methods used to measure both SC and depressive outcomes.

Among the interventions included in this review, those rooted in in-person, socially embedded interactions, such as intergenerational programs, appeared more consistently effective than those relying on passive or digitally mediated formats. While our review does not allow for a direct comparison with structured psychotherapeutic or skill-building interventions, the findings suggest that interventions replicating the richness, reciprocity, and contextual relevance of everyday social ties may be particularly well-suited to addressing the relational dimensions of depression. Hybrid models that combine digital accessibility with in-person depth offer a particularly promising path forward, especially for populations facing structural or geographic barriers to social participation.

The effectiveness of SC interventions may also depend on the baseline architecture of individuals' social networks. Those with underutilized but intact networks may respond well to programs that reactivate dormant ties. In contrast, individuals with limited or dysfunctional networks may require more foundational support, such as guided social scaffolding or targeted inclusion efforts, before they can meaningfully benefit from SC-focused interventions. Future research should explicitly examine these differential trajectories to tailor strategies accordingly.

A critical gap remains in understanding the mechanisms through which changes in SC influence depressive symptoms. Few studies directly link improvements in SC measures with clinical outcomes, and even fewer disentangle the specific dimensions (such as network size, perceived support, or social identification) that drive these effects. Bridging this gap will require integrative methodological models that combine quantitative and qualitative data, as well as longitudinal designs capable of capturing dynamic, bidirectional interactions over time.

To increase the reach, sustainability, and ecological validity of SC programs, researchers and policymakers should prioritize the development of hybrid interventions that merge online platforms with real-life social engagement. In parallel, digital technologies such as smartphone apps, wearable sensors, and EMAs should be leveraged to gather data on both objective and subjective dimensions of SC. These tools, combined with validated age- and context-appropriate SC metrics, will be crucial for improving measurement consistency and enabling targeted, scalable interventions across the lifespan.

Finally, policy support is essential to foster environments where SC is not only possible but actively facilitated (i.e., through urban planning, workplace design, educational systems, and community infrastructure). Pursuing this direction requires a coordinated effort across public health, clinical research, and social policy to ensure that interventions addressing SC are embedded into broader strategies for mental health promotion.

Author agreement

All authors have seen and approved the final version of the manuscript being submitted. The submitted article is the authors' original work, hasn't received prior publication and isn't under consideration for publication elsewhere.

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Conceptualization. **Marta Borgi:** Writing – original draft, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

Authors have nothing to declare (no financial and personal relationships with other people or organizations that could inappropriately influence or bias authors' work).

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Supplementary materials

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