BMJ Open

A SYSTEMATIC REVIEW OF THE EFFECTIVENESS OF LINK WORKERS PROVIDING SOCIAL PRESCRIBING ON HEALTH OUTCOMES AND COSTS FOR ADULTS IN PRIMARY CARE AND COMMUNITY SETTINGS.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2022-062951
Article Type:	Original research
Date Submitted by the Author:	24-Mar-2022
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Keywords:	SOCIAL MEDICINE, PRIMARY CARE, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Word count: 5,543

ABSTRACT

Objectives: To establish the evidence base for the effectiveness and costs of link workers in improving health outcomes for people in primary care and community settings with a particular focus on individuals living in deprived areas and with multimorbidity.

Methods: A systematic review of the literature for randomised and non-randomised trials examining use of link workers, or equivalent, based in primary care or community settings for community dwelling adults compared to usual care. Primary outcomes were health related quality of life (HRQoL) and mental health. Secondary outcomes included patient reported outcomes measures, physical activity, clinical outcomes, healthcare utilisation and costs. Two authors independently screened abstracts, selected studies, extracted data, evaluated study quality and judged certainty of the evidence. Results were synthesised narratively.

Results: Seven studies including 3,341 participants were included. Two studies specifically targeted people with multimorbidity and three targeted people living in areas of deprivation. Four studies reported no impact on HRQoL. Four studies reported mental health outcomes with three reporting no impact. There was no evidence of impact on most secondary outcomes apart from improvement in self-rated health in two studies and two studies in a specific setting found improved ratings of high quality care and reduced hospitalisations. Two studies reported costs, but there were no cost effectiveness analyses. The certainty of the evidence was low or very low.

Conclusion: There is very limited evidence for social prescribing link workers generally and for people with multimorbidity in areas of deprivation. Policy makers should note the limited evidence base and support robust evaluation of current programmes before mainstreaming social prescribing link workers.

Prospero registration: CRD42019134737 (04/07/2019)

STRENGTHS AND LIMITATIONS

- We conducted a worldwide search for link worker social prescribing interventions, rather than focusing on a specific geographic location and included equivalent roles across all healthcare systems.
- We only included randomized trials and controlled before after studies that met the Cochrane Effectiveness of Practice and Organisation of Care guidance, to avoid potentially biased results from poorer quality studies.
- This is the first systematic review that specifically examined the evidence for social prescribing link workers for people with multimorbidity and in areas of deprivation.
- The limited number of studies and heterogeneity in study design and intervention meant a meta-analysis was not possible. We conducted a robust narrative synthesis including an assessment of the certainty of the evidence.

INTRODUCTION

Social prescribing is a way of linking people with complex needs to non-medical supports in the community. There are different models of social prescribing, ranging from online signposting services to individual support from a link worker to access community resource. The link worker model of social prescribing is most frequently used in the UK.(1) Link workers determine the health and well-being needs of people referred to them (usually by health care professionals), co-produce a health and well-being plan and provide support to connect with community resources to meet these needs. No qualifications are specified for link workers, rather there is a focus on relevant experience and skills, such as listening and empathising, to perform the role.(2) Many health systems are developing social prescribing initiatives and NHS England is funding link workers in primary care and recommends their use for people who have one or more chronic conditions, need support with their mental health, are isolated or who have complex social problems.(3)

People experiencing multimorbidity (defined as two or more chronic health conditions) need support with managing their conditions. They experience fragmented care, poorer health outcomes and more psychological stress and as multimorbidity becomes the norm among an aging population, it poses a significant challenge to health systems.(4) People with complex multimorbidity account for a higher proportion of hospital admissions and therefore costs, and have higher consultation rates than those without.(5) In socially deprived areas, the impact is greater as people experience earlier onset of multimorbidity and are more likely to have mental health comorbidities.(6) A 2021 systematic review of interventions targeting people with multimorbidity in primary care identified 16 RCTs but found limited evidence for interventions that improve outcomes including HRQoL and mental health outcomes.(7)

The review did not identify any eligible social prescribing linkworker interventions but concluded that existing evidence suggests that future research should target a range of areas including patient health behaviours that can be addressed though social prescribing.

Link workers providing social prescribing may have an impact on health outcomes for people experiencing multimorbidity, particularly in areas of social deprivation, but despite their widespread roll out in the U.K., there is limited evidence for their effectiveness.(8) If effective, social prescribing should reduce health care costs, by addressing the social problems that reportedly drive 20% of primary care attendances and the social determinants of health that lead to poorer outcomes.(9) A recent systematic review however, concluded that there was a lack of evidence for how, for whom and when social prescribing was effective or how much it cost.(10) Previous reviews have only looked at U.K. based interventions and included a broad range of studies including those with uncontrolled designs.(11, 12) We aimed to systematically review the evidence of effectiveness and costs of link worker social prescribing interventions internationally and to establish the evidence, if any, for their effectiveness in people with multimorbidity and social deprivation.

METHODS

We conducted a systematic review of studies reporting effectiveness and/or costs of linkworkers based in primary or community care settings for community dwelling adults. We included randomized trials and non randomized trials that met the Cochrane Effectiveness of Practice and Organisation of Care (EPOC) guidance on eligible study designs.(13) We followed the PRISMA statement for reporting systematic reviews, (14) (Appendix 1) and registered our review on Prospero CRD42019134737 (04/07/2019).

Eligibility criteria

Participants/population

We included studies on community dwelling adults attending primary care. Participants did not need to have any specific index condition. We included all studies whether they focused on participants in areas of social deprivation or not, but we specifically extracted data on social deprivation and multimorbidity where it was reported. We excluded studies on children and those in residential or supported care.

Intervention

Link workers may be known by other terms such as community health workers, patient navigators or health facilitators. While all of these work in the area of health, they are generally considered "lay workers" as they have not completed formal professional health or social care qualifications. Similarly the process of social prescribing may be known by other terms such as "community referral" or "navigation". Inclusion was based on the function of the role, i.e. supporting people to improve their health and wellbeing through connecting them with community resources and health and social care coordination, recognising that there is a wide range of terms used to describe such roles.

We included interventions that involved

- A referral (including self-referrals) to a link worker (a non-health or social care professional) who was based either in a primary care practice or a community or voluntary organisation
- Participants meeting with a link worker face to face at least once

- Determining an individual range of health and social care supports and community resources that the person would be willing to engage with and being offered support and follow up to engage with their chosen supports and activities

We excluded interventions without a link worker that only involved signposting to services, used volunteers as link workers or were delivered by telephone. Interventions where additional support was being provided by health care professionals or personal care provided alongside health and social care coordination such as disability support workers were excluded as it was not possible to separate the effects of the different components of care. We excluded multi-faceted interventions, which mainly comprised of education and goal setting around disease control or health behavior change interventions, even if they had an element of social prescribing as it was not possible to separate the impact of the different components of the intervention.

Comparator(s)

We only included studies with a comparator group that did not involve any social prescribing and met the EPOC guidance on controlled before after (CBA) studies, i.e. contemporaneous data collection, controls drawn from similar sites and at least 2 intervention and 2 control sites.(13)

Setting

Primary care was generally defined as “care provided by clinicians that are available to treat all common conditions in all age groups and have an ongoing relationship with their patients”.(15) This definition allowed for a more flexible interpretation in countries that have different models of healthcare. We excluded studies that focused on hospital inpatients or specialist services or were emergency department based. The definition of social deprivation

is debated. It varies from country to country and is usually based on relative socioeconomic capacity.(16) For this review, we did not have a definition of deprivation, rather we described how deprivation was defined in relevant studies.

Outcomes

Main outcome

We included all reported outcomes, but based on our interest in assessing link workers to support patient with multimorbidity, we focused on outcomes in the core outcome set for multimorbidity that recommends primary outcomes of quality of life, mental health and mortality for interventions focused on multimorbidity.(17)

The primary outcomes for the review were:

- Health related quality of life (HRQoL), as measured by a validated instrument.
- Mental health outcomes, as measured by a validated instrument for screening for mental health conditions.

Additional outcomes

Secondary outcomes included also focused on the core outcome set for multimorbidity.(17) While this is a wide range of outcomes it is in keeping with the MRC frameworks' guide on using multiple outcome measures for complex interventions.(18) These included:

- Patient-reported outcomes on social-connectedness or isolation, self-rated health, patient experience of care, treatment burden, self-management behaviour and self-efficacy.

- Physical activity and function included measures of physical activity (self-reported or objectively measured), physical function, activities of daily living.
- Health service utilisation defined as number of GP visits, ED attendances or hospital admissions as measured via primary care or hospital records or self-reported.
- Any physical health data reported was included.
- Any cost data or social return on investment data.

Search strategy

We searched 11 bibliographic and trials databases for randomised controlled trials and non-randomised controlled trials that meet the criteria outlined in the Cochrane Effective Practice and Organisation of Care (EPOC) guidance on study design(13) from inception up to July 2021 with no language limits: Cochrane database, Cochrane Central register of Controlled trials, ClinicalTrials.gov and EU Clinical Trials Register, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Embase, Global Health, PubMed/MEDLINE, Psychinfo, LILACS (Latin American and Caribbean Health Sciences Information database) and Web of Science. To identify economic evaluations that may be of relevance we also searched the NHS EED (NHS Economic Evaluation Database), Health Technology Assessment Database (both available via the Centre for Reviews and Dissemination (CRD), University of York) and CEA (Cost-Effectiveness Analysis Registry) up to July 2019. We conducted a grey literature search of the following databases: Irish Health Service Executive (HSE) Lenus, RIAN, Open Grey, DART EUROPE, Google and Google Scholar and WHOLIS (World Health Organization Library Information System) up to July 2021. We also conducted a forward and backward citation search of included studies. Relevant websites (The Kings Fund, NHS Social Prescribing, National Institute for Clinical Excellence, Social Prescribing Network, Health Foundation, Nuffield Trust, HSE Social Prescribing, and Oxford

Social Prescribing Research Network) were searched for evaluations. The first 23 pages of a Google Search for "social prescribing" and the first 21 pages of a Google scholar search were reviewed for additional literature. Please see Extended data, Appendix 2 for sample search strategy.

Data management

Rayyan was used to sort abstracts for inclusion and exclusion. References were managed with Endnote 8 reference manager.

Review Process

The lead author (BK) did an initial screen to remove clearly ineligible titles. BK and AC independently reviewed the abstracts of all potentially eligible titles, discarded those that clearly did not meet inclusion criteria and independently reviewed the full texts of the remainder to assess eligibility for final inclusion. Any discrepancies were resolved through discussion with a third reviewer (SMS). Data extraction was completed by the lead author and checked by another author (MOS). Two authors (BK and AC) independently assessed and cross-checked the risk of bias in all included studies using the Cochrane EPOC Guidance for assessing risk of bias.(19) The certainty of the evidence for outcomes was independently assessed by two authors (BK and MOS) using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria including risk of bias, consistency of effect, imprecision, indirectness and other potential criteria such as publication bias.(20) Any discrepancies were discussed with the senior author (SMS) until consensus was reached. RCTs and CBAs were assessed separately. Overall certainty was based on assessment of evidence from RCTs where more than one was available.

Strategy for data synthesis

Due to the heterogeneity in terms of study design, risk of bias, participants, interventions and outcomes, a narrative synthesis was performed and presented in tabular form to include the following headings: study design, setting, participants, nature of intervention, outcome measures used, effects and costs. We explored the possibility of completing meta-analysis, however, in the two studies that were similar in terms of study design, intervention characteristics and duration of follow up, there was insufficient data reported on the primary outcomes. As there were only two studies, authors were not contacted for additional data. We had planned to complete sub-group analyses based on multimorbidity, living in areas of social deprivation and link worker location, but this was not possible due to substantial methodological heterogeneity, including study design and definitions and reporting of multimorbidity and deprivation.

Public Patient Involvement

This review is part of one of four PhD projects under a Health Research Board collaborative doctoral award (CDA) in multimorbidity. The original CDA project application and PhD topics had input from a PPI advisory group. A multimorbidity PPI advisory group was set up specifically to support the four PhD projects in the CDA. The lead reviewer (BK) presented the results of this review to the group who provided input on implications for policy, practice and research, included in the discussion. See Appendix 3 Guidance on Reporting Involvement of Public and Patients (GRIPP) 2 form in extended data for further details on PPI methods.

RESULTS

The database search identified 20,656 records after duplicate removal. 19,726 were removed after title screening leaving 930 abstracts for review. 315 full texts were assessed for eligibility including 221 identified from the database search and 94 from other sources. (See Figure 1: PRISMA Flow diagram)

Included studies and participants

Eight papers reporting seven studies, including 3,341 participants were identified. Four were randomized trials (RCTs),(21-24) three controlled before after studies (CBAs)(25-27) and one paper reported the economic evaluation of an included trial.(28) Two studies were from the US(23, 24) and five from the UK.(21, 22, 25-27)

Participants were majority female ranging from 59% to 75% with only one study reporting majority male participants (62%).(25) Mean age ranged from 43.2 to 71 years age. One study focused on adults over 75, but did not report mean age.(21) Three of the seven studies clearly reported including participants experiencing multimorbidity and deprivation. The two US trials tested an intervention that targeted people with two or more chronic conditions, living in a high poverty zip code.(23, 24) One U.K. study was based in GP practices located in postcodes with high deprivation and reported a mean of 3.1 self- reported chronic conditions.(26) Otherwise, studies recruited participants based on a combination of factors including: social isolation,(21, 25, 27) mental health problems,(25, 27) age (21, 25) and GP perception of suitability for the intervention.(22, 26, 27)

Interventions and comparators

All interventions included referral to a link worker or equivalent, who identified a set of personalized goals and supported participants to achieve these through connecting with community resources. There was considerable variation in the duration and intensity of the link worker interventions. Intervention duration ranged from one month to two years, with most interventions ranging from three to nine months in duration. Intensity in terms of link worker caseload and number of contacts was only reported in detail in two of the seven studies. The IMPaCT intervention evaluated in the two US trials was six months duration with weekly contacts as standard. Each link worker worked with 55 clients per year for an average of 38.4 hours.(29) No other studies reported on link worker caseload. Other interventions were less intense in terms of number of contacts. Carnes et al reported that 69% of participants met the link worker once and 17% had two or more contacts.(27) Grant et al reported a mean of 1.7 contacts and Mercer et al a mean of 3.1 contacts.(22, 26) The remaining two studies did not report on numbers of contacts.(21, 25)

All link workers had professional supervision arrangements, which varied across studies. They were managed and employed by either a research team or a host voluntary community organisation. While efforts were made to standardise the IMPaCT intervention,(29) with regular supervision and reviews, the other interventions were very flexible and fidelity was not assessed. In some cases, there was considerable variation in how the intervention was implemented across sites, but this was part of a general tailored approach.(25, 26) The setting also varied. In three studies, link workers were embedded within general practice or equivalent.(24, 26, 27) In two of these studies one link worker was assigned to a practice. (24, 26) In the other, three link workers were based across 22 practices.(27) The link workers were based in community settings in the remaining four studies.

The comparator was usual care for all studies, with the inclusion of chronic disease goal setting as a co-intervention in two of the RCTs.(23, 24) The four RCTs randomized participants at the level of the individual. The three CBAs studies recruited controls from nearby GP practices with similar demographics. However, all of the CBAs reported significant differences in demographics and baseline outcome scores between intervention and control groups. See Table 1 for a summary of included studies.

Table 1. Summary of included study characteristics.

Study ID	Participants	Intervention	Oucomes
Randomised Trials			
Clarke et al, 1992 (21) Community, UK	523 adults over 75 living alone. Age, gender not reported	**Referral:** Recruited via mail invitation **Linkworker:** Lay community-based health worker, training and experience not specified. **Contacts:** Minimum 3 home visits with tailored support **Duration:** 2 years **Type of support**: Tailored but fell into 4 categories: Social & social services, financial, housing & healthcare coordination **Comparator:** Usual care	**Primary outcome:** Survival **Secondary outcomes:** Activities of daily living Information/orientation score Loneliness Morale Self-rated health Social contacts Primary healthcare utilisation **Costs:** None reported **Data collection:** 0, 24 months. Survival assessed at 6 monthly intervals from baseline to 3.5 years
Grant et al, 2000 (22) Community, UK	152 adults over 16 who GP felt would benefit from intervention. Mean age 43.2, 75% female.	**Referral:** Recruited via GP referral **Linkworker:** Lay "referral facilitator" trained and employed by a community organisation. Based in community. **Contacts:** 1 face-to-face assessment within a week of referral. Average of 1.7 telephone or face-to-face contacts reported. **Duration:** 1 month **Type of support**: Assessment and referral to appropriate community resources **Comparator:** Usual care	**Primary Outcomes:** Mental health: depression and anxiety Social Support **Secondary outcomes:** Quality of life Functional health Primary healthcare utilisation including medications and referrals **Costs:** Intervention Primary healthcare utilisation Referrals to other agencies **Data collection:** 0, 1, 4 months
Kangovi et al, 2018 (24) Primary Care, USA	592 adults attending 3 primary care clinics, who resided in a high-poverty zip code, were uninsured or publicly insured, and had a diagnosis for 2 or more chronic diseases. Mean age 52.6. 62.5% female.	**Referral:** Recruited via primary care clinics **Linkworker:** Community health workers, with high school diploma. 1 month training in motivational interviewing, action planning and on the job. Based in primary care practices. **Contacts:** Monthly face-to-face meetings and weekly telephone check ins. **Duration:** 6 months **Type of support**: Tailored supports to achieve chronic disease goals set with PCP including: Action planning and coaching, health system navigation and advocacy, long term social supports **Comparator:** Chronic disease goal setting with PCP only	**Primary outcome:** Health related quality of life, physical health component (SF-12-V2 PCS) **Secondary outcomes:** Health related quality of life, mental health component (SF-12-V2 MCS) Patient activation Chronic disease control (BP, HbA1C, BMI or CPD) Patient-reported quality of primary care All cause hospitalisations **Costs:** None reported **Data Collection:** 0, 6, 9 months
Kangovi et al, 2017 (23) Community, USA	302 adults attending GIM clinics, uninsured or publicly insured, living in deprived area, and were diagnosed with 2 or more chronic	**Referral:** Recruited via primary care clinics **Linkworker:** Community health workers, with high school diploma. 1 month training in motivational interviewing, action planning and on the job. Based in primary care practices. **Contacts:** Monthly face-to-face meetings and weekly telephone check ins. **Duration:** 6 months **Type of support**: Tailored supports to achieve chronic disease goals set with PCP	**Primary outcome:** Change in chronic disease control (HbA1C, BMI, BP, or CPD) **Secondary outcomes:** Achievement of chronic disease management goals Health related quality of life (SF-12-V2 PCS and MCS) Patient activation Patient reported quality of primary care All cause hospitalisations

	diseases. Mean age 56. 74% female	including: Action planning and coaching, health system navigation and advocacy, long term social supports **Comparator:** Chronic disease goal setting with PCP only	**Costs:** Return on investment analysis reported on cost savings related to reduced hospitalisations **(28)** **Data collection:** 0, 6 months for PROMs. 6 and 12 months for hospitalisations
Controlled Before After Studies			
Study ID	**Participants**	**Intervention**	**Outcomes**
Carnes et al, 2017 (27) Primary Care, UK	480 adults frequently attending primary care, who presented with social isolation or mild mental health problems. Median age 56. 59% Female.	**Referral:** GP referral **Linkworker:** 3 lay "social prescribing coordinators" (SPC) trained in social work and managed by community organisation. Based across 22 GP practices. Additional support from volunteers available. **Contacts:** Initial 1 hour meeting and up to 6 sessions with the SPC, unlimited volunteer support **Duration:** 6 months **Type of support**: Assessment and well-being plan, referral and support to access community resources. Volunteers available to accompany to resources if required. **Comparator:** Propensity matched controls drawn from GP practices in nearby areas with no social prescribing service.	**Primary outcome:** Not specified **Secondary outcomes:** Self-rated health Mental Health: depression and anxiety Wellbeing Positive and active engagement in life Number of regular activities A&E visits in past 3 months Annual GP consultation rate Number of medications in previous 6 months **Costs:** None reported **Data collection:** 0, 8 months
Dickens et al, 2011 (25) Community, UK	392 adults over 50 attending primary care at risk of social isolation. Mean age 71. 62% male	**Referral:** GP referral **Linkworker:** Mentors often with teaching or creative skills, managed by a community organisation. Training not described. Based in community. **Contacts:** Face to face meetings, frequency not specified **Duration:** 3 months **Type of support**: Build confidence for personal social activities using personalised incremental goal setting **Comparator:** Matched controls from a sample drawn from 3 GP practices in nearby areas with no mentoring service	**Primary outcome:** Health related quality of life, mental health component (SF-12-V2 MCS) **Secondary outcomes:** Health related quality of life, physical health component (SF-12-V2 PCS) Health related quality of life (EQ-5D-3L) Mental health: depression Social activities Social support Social participation **Costs:** None reported **Data collection:** 0, 3 months
Mercer et al, 2019 (26) Primary Care, UK	900 adults attending primary care in most deprived areas of Glasgow deemed suitable for intervention by GP. Median age 49. 60% Female.	**Referral:** GP referral **Linkworker:** Community links practitioners with prior experience of community work, managed by a community organisation. 1 month training on role, supporting clients, engaging practices and mapping resources. Based in GP practices. **Contacts:** Face to face meetings. Average of 3 meetings reported. **Duration:** 9 months **Type of support**: Assessment of needs and tailored support to connect with relevant community resources. **Comparator:** Sample drawn from 6 GP practices in Glasgow without a community links practitioner	**Primary outcome:** Health related quality of life (EQ-5D-5L) **Secondary outcomes:** Wellbeing Mental Health: depression and anxiety Work and social adjustment scale Self-reported lifestyle behaviors (smoking, alcohol, exercise) **Costs:** None reported **Data collection:** 0, 9 months

Risk of Bias

We used the EPOC guidance to assess risk of bias for both RCTs and CBAs, but have reported them separately for each study design. The RCTs had low risk of bias overall, despite blinding of participants not being possible given the nature of the intervention. Randomization processes were not clearly reported in one RCT.(21) There was high risk of bias in the CBAs. This was due to differences in baseline characteristics and limitations in randomization and allocation concealment due to study design. A summary of the risk of bias is shown in Figure 2. The full risk of bias assessment for all outcomes is available in Appendix 4 in extended data.

Certainty of Evidence

For the primary outcomes, the certainty across all study types was low for HRQoL and very low for mental health due to risk of bias, indirectness resulting from differences in interventions and populations across studies, inconsistencies in results and imprecision. The certainty was low for social supports, self-rated health and very low for physical function and activities. For health care utilization, there was low certainty evidence for hospitalisations based on the two RCTs of the IMPaCT intervention.(23, 24) There was low certainty evidence for primary care visits, due to indirectness, imprecision and risk of bias. See Table 2.

Table 2. Grade Summary of Findings

Title: The effectiveness of link workers providing social prescribing on health outcomes and costs for adults in primary care and community settings
Patients or population: Community dwelling adults
Settings: Primary and community care
Intervention: Social prescribing link workers
Comparison: Usual care

Outcome	Review finding	Contributing studies (participants)	Overall GRADE assessment
Health related quality of life	Link workers providing social prescribing may have little or no impact on HRQoL.	2 RCTs (894). 2 CBAs (1292)	⊕⊕⊖⊖ Low (Low for RCTs [b, c, d]. Low for CBAs)
Mental health	It is unknown if social prescribing link workers improve mental health because the certainty of the evidence is very low.	1 RCT (152). 3 CBAs (1772)	⊕⊖⊖⊖ Very Low [f] (Low for RCT [b,c] and Very Low for CBAs [a,b])
Social contacts and support	Social prescribing link workers may lead to little or no difference in social contacts.	2 RCTs (714). 1 CBA (392)	⊕⊕⊖⊖ Low (Low for RCTs [b,d], Low for CBAs)
Physical function and activities	It is unknown if social prescribing link workers improve physical function and activity because the certainty of the evidence is very low.	2 RCTs (714) 2 CBAs (1380)	⊕⊖⊖⊖ Very low (Very Low RCTs [b,c,d] and Very Low CBAs [a,d])
Self-rated health	Social prescribing link workers may improve self-rated health.	2 RCTs (714) 1 CBA (480)	⊕⊕⊖⊖ Low (Low RCTs[b,c] and Low CBA[a])

Health care utilisation: hospitalisation	Link workers providing social prescribing via a structured intervention and within a specific health context may decrease hospitalisations.	2 RCTs (894)	⊕⊕⊖⊖[b,c,e] Low
Health care utilisation: primary care visits	Social prescribing link workers may have little or no impact on primary care visits.	2 RCTs (714) 1 CBA (480)	⊕⊕⊖⊖ Low (Low RCTs [b,d], Very Low for CBAs [a])

RCTs and CBAs were assessed separately for each outcome. If there was limited RCT evidence then an overall judgement was applied. In this case if were inconsistencies in results between the two bodies of evidence this was downgraded by one level.

[a] Downgraded for risk of bias . [b] Downgraded for indirectness. [c] Downgraded for Inconsistency. [d] Downgraded for imprecision. [e] Downgraded for publication bias [f] Downgraded for overall inconsistency

See Appendix 5 in extended data for the full GRADE summary sheet.

Effectiveness of link worker interventions

Primary outcomes

Four of the seven studies (two RCTs and two CBAs) reported on HRQoL (23-26) . Two studies used the EQ-5D measure with one study reporting no difference, (26) while the other study reported a small significant difference between the intervention and control group, in favour of the control group. (25) Three studies used the SF-12 measure, with one of the three reporting a significant difference in favour of the intervention for the mental health component score, (23) whereas, none of the three studies reported any difference in physical component scores (23-25). Four studies reported on mental health (22, 25-27) using HADS-D, HADS-A or GDS-10. Only one of these studies reported evidence of a significant improvement in HADS-A, (aMD -1.9 (95% CI: -3.0 to -0.7).(22) The remaining three studies

found no evidence of a difference between groups for any mental health outcomes. See Table 3 for a summary of the primary outcome effects.

Table 3 Summary of review primary outcome effects

Health Related Quality of Life		
Study ID	**Outcome measure**	**Adjusted mean differences (95% CI)**
Kangovi et al, 2018 RCT (24)	Physical Health Component (SF-12-V2 PCS)	−0.7 (−2.2 to 0.7) [a] P=0.3
	Mental Health Component (SF-12-V2 MCS)	0.8 (−1.1 to 2.6) [a] P=0.41
Kangovi et al, 2017 RCT (23)	Physical Health Component (SF-12-V2 PCS)	Int 0.9, Control 0.5* P=0.66
	Mental Health Component (SF-12-V2 MCS)	Int 2.3, Control 0.2* P=0.008
Dickens et al 2011 CBA (25)	Physical Health Component (SF-12 PCS)	0.8 (-1.5, 3.2) [b] P=0.48
	Mental Health Component (SF-12 MCS)	0.1 (-1.9, 2.1) [b] P=0.9
	EQ-5D-3L	-0.09 (-0.14, -0.03) [b] P=<0.001
Mercer et al, 2019 CBA (26)	EQ-5D-5L	0.008 (–0.028 to 0.045) [c] P=0.648
Mental Health		
Study ID	**Outcome measure**	**Adjusted mean differences (95% CI)**
Grant et al, 2000 RCT (22)	Depression (HADS-D)	−0.9 (−1.9 to 0.2) [d] P=0.116
Carnes et al, 2017 CBA (27)	Depression (HADS-D)	0.857 (−0.737, 2.451) [e] P=not reported

Dickens et al, 2015 CBA (25)	Depression (GDS-10)	0.2 (-0.2, 0.7) [b] P=0.29
Mercer et al, 2019 CBA (26)	Depression (HADS-D)	0.09 (–0.49 to 0.68) [c] P=0.753
Grant et al, 2000 RCT (22)	Anxiety (HADS-A)	−1.9 (−3.0 to −0.7)[a] P=0.002
Carnes et al, 2017 CBA(27)	Anxiety (HADS-A)	−0.119 (−0.847, 1.609) [e] P=not reported
Mercer et al, 2019 CBA (26)	Anxiety (HADS-A)	–0.41 (–0.99 to 0.18) [c] P=0.172
Clarke et al, 1992 RCT (21)	HRQoL or Mental Health were not outcomes for this trial	

SF-12v2= Short Form Health Survey, is often used as a health related quality of life measure, with Physical (PCS) and Mental (MCS) health components reported separately on a scale of 0-100 with 100 representing maximal health. EQ-5D-5L=a standardized measure of self-reported health-related quality of life that assesses 5 dimensions at 5 levels of severity where 1 is the preferred state of health. EQ-5D-3L=an earlier version of EQ-5D-5L with 3 levels. GDS =Geriatric Depression Scale, a screening tool for depression in older people with a score of 4 or more indicating possible depression. HADS = Hospital Anxiety and Depression Scale measured on a scale of 0-42 where a higher score indicates worse mental health. HADS-A=Hospital Anxiety and Depression Scale, Anxiety, where a score above 10 indicates possible caseness; HADS-D=Hospital Anxiety and Depression Scale, Depression, where a score above 10 indicates possible caseness.

.* Unadjusted mean difference- adjusted mean differences not reported [a] Longitudinal estimated difference in difference from 6 to 9 months adjusted for site and chronic disease. [b] Adjusted for employment status, accommodation type and living circumstances. [c] Adjusted for age, sex, SIMD, comorbidity, and significant baseline outcome measures as covariates and includes practice identifier as a random effects term. [d] Adjusted for baseline results [e] Adjusted for age, sex, ethnicity, employment status and living arrangement.

Secondary outcomes

A wide range of other outcomes was reported, with the studies reporting a mean of six outcomes each, including a range of patient reported outcomes (PROMS). Three reported on a measure of social contact or support and found no evidence of a difference between groups (21, 22, 25). One study reported that intervention participants were more likely to rate getting along with others as “worse” than controls, indicating a possible negative effect (25). In terms of other PROMs, two studies found a positive impact on self-rated health (21, 22), one study found a positive effect for general quality of life, assessed by the Delighted Terrible Faces

scale (22) and two studies reported a positive finding on patient rating of high quality care (23, 24). There were no reported differences for patient activation (23, 24), wellbeing (26, 27), loneliness (21), morale (21), work and social adjustment (26) or active participation in life (27). Of the four studies that reported a measure of physical activity and function, one study found an improvement in functional health (22), while two others found no evidence of a difference in ADLs (21), or physical activity (26) and the final study found a reduction in usual activities (27). Three studies reported clinical outcomes, one reported on survival over a three year period (21) and two looked at chronic disease control for smoking, diabetes, obesity and hypertension (23, 24). None reported a statistically significant difference between groups.

Five studies reported on health care utilization, with three reporting on primary care utilization (21, 22, 27) and two on hospitalisations (23, 24). One study reported a reduction in primary care attendances in the intervention group, but the control group were significantly different and the authors concluded that their findings more likely represented regression to the mean (27); the remaining two studies found no evidence of an effect on primary health care attendances. One of the two US studies found a 24 % risk reduction in repeat hospital admissions during the 12 month follow up period (24); the other US study reported a similar reduction, but it did not reach statistical significance (23). See Appendix 6 in extended data for a full list of outcomes and effects for each study.

Costs and cost effectiveness

No cost utility or cost effectiveness analyses were identified in our search. Two RCTs reported on costs (22, 28); one as a cost analysis and the other as a separately published return on investment analysis of an included RCT (23). The cost analysis looked at primary care visits, medications, referrals and interventions costs. While the study found a reduction

in healthcare costs due to a reduction in referrals, these savings did not offset the costs of the intervention. Therefore, the authors concluded that the intervention was more costly than usual care. The analysis did not consider any measure of health benefits to participants such as quality of life years gained.(22) The return on investment study examined cost savings related to hospitalisations and outpatient attendances from routine data and included detailed costing of the intervention, which was calculated at $1721.06 per participant. While the number of reduced hospital days was statistically non-significant, they estimated a return of $2.47 for every $1 spent on the intervention.(28)

Subgroup synthesis- Multimorbidity and social deprivation

Three of the seven studies reported number of chronic conditions. Two of these were RCTs of the IMPaCT intervention in the US and recruited participants with two or more chronic conditions including hypertension, diabetes, obesity and tobacco dependence.(23, 24) The other was a CBA of the Glasgow Deep End link worker intervention and reported a mean of 3.1 chronic conditions in the intervention group, but this was not an inclusion criterion.(26) All three of these studies targeted participants in areas of deprivation. Within these multimorbidity studies, there was no conclusive effect on HRQoL, with two of the studies finding no effect and one of the US trials finding an effect on the Mental Health Component of the SF-12-V2 only,(23) which was not replicated in the second trial of this intervention.(24) Only the Deep End link worker CBA reported on mental health and found no evidence of a difference between groups. There were no reported significant effects on other patient reported outcome measures or chronic disease control. The RCTs of the IMPaCT intervention found a consistent improvement in the proportion of participants reporting high quality primary care. Both also examined hospitalisations, reporting fewer

total days in hospital, although this only reached statistical significance in one of the two studies.

DISCUSSION

We identified seven studies and one economic evaluation of an included study, but found no consistent evidence to support the effectiveness of link worker interventions for improving health related quality of life or mental health. There was no evidence for effectiveness in improving social support, physical function and activities, or primary healthcare utilization, though there was a suggestion from two studies that interventions led to improved self-rated health and two others reported higher patient ratings for quality care. Three of the studies specifically included participants experiencing multimorbidity and social deprivation with similar findings for health related quality of life, though two U.S. RCTs reported a reduction in total days in hospital for people with multimorbidity with low certainty evidence. The certainty of the evidence is low or very low overall due to risk of bias, heterogeneity amongst studies, inconsistency and imprecision.

Our systematic review has not identified any evidence on the cost effectiveness of social prescribing. There is some evidence of cost savings based on reduced hospitalisations, but this was a US based study of an intense structured six-month intervention and may not translate to other healthcare systems.(28) Only one UK based study reported costs, showing a reduction in referral costs, but no cost benefit analysis or cost utility analysis was undertaken.(22) The economic evaluation of social prescribing in the literature is weak.

There remains a lack of studies with a randomized design since the 2017 review (10) that called for “less rhetoric and more reality”. There have been many uncontrolled before after studies identified in subsequent reviews, (11, 12, 30) but the last RCT in a UK setting was over 20 years ago. (22) Widening our search beyond the UK setting resulted in the

identification of two relevant RCTs and a return on investment analysis in a US setting. (23, 24, 28) Ours is the first review to look specifically at populations experiencing multimorbidity or deprivation. We identified some evidence to support reduced hospital admissions for people experiencing multimorbidity and deprivation in the US. Two of these studies also found an improvement in patients rating of the quality of their primary care, which has been reported in previous multimorbidity studies. (31). The 2021 systematic review of multimorbidity highlighted the potential for interventions to improve patients experience of care, (7) which some have argued should be an end in itself. (32). We reported on the intensity of the intervention, often omitted from previous reviews and indeed in many of the articles in this review. While intensity varied, a more intense intervention with a healthcare coordination component was the only one with a positive impact on healthcare utilisation.(28) Setting also varied, with some link workers embedded in general practice, which may facilitate healthcare coordination.

The main outcomes for the current review were HRQoL and mental health based on the core outcome set in multimorbidity (17), but only two of the seven studies reported on both of these (25, 26). With one exception (21) the rest reported on at least one. Most studies did cover some of the NHS draft outcome framework for social prescribing recommended outcomes: wellbeing, social connectedness, ability to manage day-to-day and physical activity. (3) However, as per previous reviews (10, 11, 33) there was a lot of variation in outcomes included and how they were measured, making it difficult to synthesise studies and further weakening the evidence.

Strengths and Limitations

This review involved a rigorous search of the international literature including all languages and the Grey Literature. We used a wide range of terms to describe the link worker role,

providing additional evidence on link worker social prescribing interventions. We had robust study design inclusion criteria and only included studies that met the Cochrane EPOC guidance for inclusion in a systematic review.(19) Additional potentially eligible studies did not meet the inclusion criteria for this review due to non-contemporaneous comparisons, too few sites or offering some sort of social prescribing intervention to control groups.(34-36) Previous reviews have included uncontrolled studies with the argument that they are used by policy makers as evidence of effectiveness,(12) however, including these studies with weaker designs can lead to inflated effect sizes and distort the current evidence base. Unlike previous reviews, (10-12, 30, 37) we appraised the overall certainty of the evidence for our selected outcomes, which was low or very low for most outcomes. This review provides the most up to date review of evidence internationally for link worker social prescribing interventions.

Due to the complex nature of link worker interventions, there may have been a degree of subjectivity in determining which ones to include. To minimize this all full texts were independently reviewed and where there was a question over intervention inclusion, it was discussed with a third author. Our protocol made it clear that it was important that social prescribing was the main element of the intervention, but interpretation of this is also dependent on reporting in potentially eligible studies (38). The field is rapidly expanding and we may have missed studies published since July 2021. Our forward citation search carried out in September 2021 will go some way to mitigate this. We are also aware of protocols that have not published results or were suspended due to COVID-19, including an RCT that we have conducted with analysis ongoing.(39)

Implications for policy and practice

It could be argued that only four of the studies tested interventions that reflect the format of current social prescribing activities in the UK, which are relatively short and tailored to the

individual and locality, with a high degree of flexibility (22, 25-27). Even among these, there is variation in terms of the intensity of support and link worker location, with both community and primary care settings. Embedding link workers in a general practice setting can facilitate more intense support and a focus on healthcare coordination, such as in the US IMPaCT intervention.(29) One of the UK studies reported that a sub-group of participants who met a link worker three or more times had improvements in HRQoL, mental health and exercise, suggesting intervention duration and intensity is important to consider.(26) Current plans for social prescribing in Ireland and the UK suggest at least double the linkworker caseload of the IMPaCT intervention, (40, 41) and a shorter intervention, that may limit link worker capacity to provide the level of support required to provide benefit, particularly for people with multimorbidity living in deprived areas. There is a need to consider greater flexibility in how new link worker social prescribing interventions are implemented until more evidence is available on how much and what type of support is required.

Policy makers need to be aware that there is insufficient evidence to assess the effectiveness of social prescribing and none on the cost effectiveness so the opportunity cost is unknown. While it is anticipated that social prescribing will reduce healthcare utilization at the primary care level (9), many evaluation of social prescribing services struggle to get access to healthcare utilisation data.(42) Going forward robust evaluations with both patient reported outcome data and access to healthcare utilisation data to assist economic evaluations need to be embedded into social prescribing programmes.

The PPI group felt a flexible approach was necessary as some people may need longer support, but it would not be fair to exclude those who have less complex needs who could benefit from shorter interventions. They agreed with the author team's conclusions that social prescribing should not be rolled out more widely without evaluations built in and also felt that outcomes and the way they were measured should be decided with patient input.

Implications for future research

For future research and evaluations to address the evidence gap a number of challenges need to be overcome. Social prescribing interventions are meant to be flexible and tailored, not just to the individual, but also the context. This however results in a lot of heterogeneity and difficulty in assessing an overall body of evidence. Future studies could address this by reporting on reasons for referral, caseload, duration of intervention, number of contacts and link worker caseload. Further research is also needed to better understand the components of social prescribing and indeed is underway.(43)

There are no agreed outcomes or measures for social prescribing. The NHS does not recommend any specific measures, although for personalized care it does recommend using the patient activation measure (PAM), (44) which was not used in any UK studies in this review, although it is relatively new. The Health Service Executive in Ireland also recommends assessing wellbeing and social connectedness, but not mental health or HRQoL (42). Without the inclusion of a measure that can be used for cost utility analysis, building the evidence base around cost effectiveness will be challenging. The EuroQoL HRQoL measure, EQ-5D-5L (45), is one such measure, but it can be difficult to show changes in a relatively short timeframe (46) and is quite health focused whereas social prescribing has potentially wider social benefits. The ICECAP-A (The ICEpop CAPability measure for Adults) is an alternative. (47) It measures capability well-being, can be used in economic evaluations and is recommended by NICE for use in evaluations of interventions with potential health and social benefits. (48) Future studies should consider its inclusion as an outcome. The Medical Research Council Framework for the Evaluation of Complex Intervention to Improve Health Outcomes recommends multiple outcome measures. In the case of social prescribing a more refined outcomes framework with specified measures developed with input from service users, providers and academics is needed.

The widespread policy of rolling out social prescribing projects regardless of the lack of certainty around cost effectiveness makes it challenging for researchers to address the evidence gap, especially in identifying suitable controls. While some CBAs in this review attempted to match controls, there were often significant differences in baseline characteristics as controls were drawn from different populations. (25, 27) Where social prescribing has already been adopted by policy makers stepped wedge cluster RCTs and interrupted time series offer an alternative approach to CBAs and can control better for confounding. (49) Other jurisdictions considering implementing social prescribing should carefully consider how they evaluate it from inception. RCTs are feasible as shown by the trials in the review. It is clear, however, that further uncontrolled before after studies will not advance the evidence base.

CONCLUSIONS

Our systematic review suggests that link workers providing social prescribing may have little or no impact on HRQoL, mental health or a range of patient reported outcomes though may improve self-rated health. For patients with multimorbidity in areas of deprivation an intensive link worker intervention probably improves patients' ratings of high quality primary care and reduces hospitalisations, but these findings are based on two studies in the US and require evaluation in other health systems. The opportunity costs of investing in social prescribing may be considerable and it is essential that high quality trials determining cost effectiveness are conducted so that the evidence can catch up with the policy and we avoid wasting valuable time and resources.

COMPETING INTERESTS

The authors declare that they have no competing interests.

ETHICS STATEMENT

This study did not involve human or animal subjects and did not require ethical approval.

FUNDING

This research was funded by the Health Research Board Ireland (Grant reference HRB CDA 2018 Reference CDA-2018-003). The funders did not have any role in the design of this study.

DATA AVAILABILITY

Extended and supplementary data are available on the Open Science Framework: Effectiveness of link workers providing social prescribing on health outcomes and costs for adult patients in primary care and community settings. A protocol for a systematic review of the literature. Extended Data.

https://osf.io/p5nv2/#:~:text=DOI%2010.17605/OSF.IO/P5NV2

This project contains the following extended data:

- Appendix 1: PRISMA checklist for "A systematic review of the effectiveness of link workers providing social prescribing on health outcomes and costs for adults in primary care and community settings."
- Appendix 2: Pubmed Search Strategy for Effectiveness of link workers systematic review.docx (PubMed search strategy)
- Appendix 3: GRIPP 2 Form for PPI

- Appendix 4: Risk of Bias tables
- Appendix 5: GRADE Assessment Sheets
- Appendix 6: All outcomes table
- https://doi.org/10.17605/OSF.IO/X6V2K

CONTRIBUTORSHIP STATEMENT

BK was the primary reviewer and designed and conducted the search, reviewed identified texts, extracted data, performed the narrative synthesis and wrote the main draft. AC was a second reviewer of identified texts and for the quality assessment. MOS performed citation searches, verified data extraction and was second reviewer for certainty of evidence assessment. FB provided statistical support, wrote the protocol for meta-analysis and advised on feasibility of same. EOS provided health economics expertise and advised on identification and summary of cost analysis studies. DC provided input into the search protocol, in particular descriptions and definitions of the link worker role. SMS conceptualised the original review questions, was involved in designing methods of the review and acted as a third reviewer. All authors contributed to critique and revisions of draft manuscripts and have approved the final version.

ACKNOWLEDGMENTS

Paul J Murphy MLIS, Information Specialist, Royal College of Surgeons Ireland Library, 26 York Street, D02 YN77. Advised on search strategies.

FIGURE LEGENDS

Figure 1. PRISMA Flow Diagram

Figure 2. Risk of Bias Summary

REFERENCES

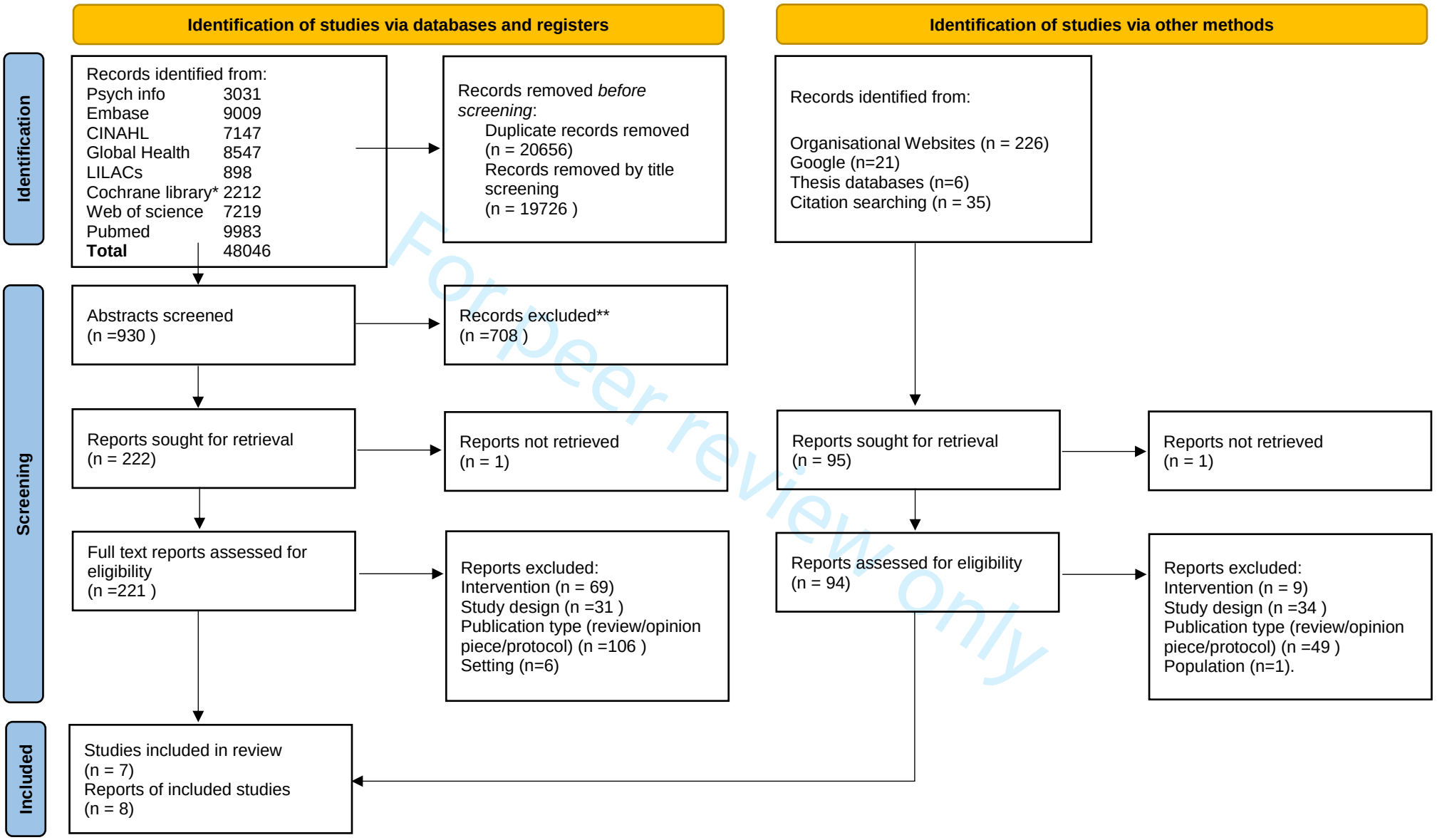
1. Polley MJ, Fleming, J., Anfilogoff, T. and Carpenter, A. Making sense of Social Prescribing. London: Univeristy of Westminiter; 2017 18/08/2017.
2. NHS. NHS Careers: Social Prescribing Link worker NHS Careers: NHS;

2021 [Available from: https://www.healthcareers.nhs.uk/explore-roles/wider-healthcare-team/roles-wider-healthcare-team/clinical-support-staff/social-prescribing-link-worker/social-prescribing-link-worker.
3. NHS. Social Prescribing England: NHS; 2020 [Available from: https://www.england.nhs.uk/personalisedcare/social-prescribing/.
4. Wallace E, Salisbury C, Guthrie B, Lewis C, Fahey T, Smith SM. Managing patients with multimorbidity in primary care. BMJ. 2015;350.
5. Payne RA, Abel GA, Guthrie B, Mercer SW. The effect of physical multimorbidity, mental health conditions and socioeconomic deprivation on unplanned admissions to hospital: a retrospective cohort study. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2013;185(5):E221-8.
6. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet. 2012;380(9836):37-43.
7. Smith SM, Wallace E, Clyne B, Boland F, Fortin M. Interventions for improving outcomes in patients with multimorbidity in primary care and community setting: a systematic review. Systematic Reviews. 2021;10(1):271.
8. Husk K, Elston J, Gradinger F, Callaghan L, Asthana S. Social prescribing: where is the evidence? The British journal of general practice : the journal of the Royal College of General Practitioners. 2019;69(678):6-7.
9. Drinkwater C, Wildman J, Moffatt S. Social prescribing. BMJ. 2019;364:l1285.
10. Bickerdike L, Booth A, Wilson PM, Farley K, Wright K. Social prescribing: less rhetoric and more reality. A systematic review of the evidence. BMJ Open. 2017;7(4).
11. Pescheny JV, Randhawa G, Pappas Y. The impact of social prescribing services on service users: a systematic review of the evidence. Eur J Public Health. 2020;30(4):664-73.
12. Vidovic D, Reinhardt GY, Hammerton C. Can Social Prescribing Foster Individual and Community Well-Being? A Systematic Review of the Evidence. International journal of environmental research and public health. 2021;18(10):5276.
13. Cochrane. Cochrane Effective Practice and Organisation of Care (EPOC): Cochrane; 2017 [Available from: https://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/Resources-for-authors2017/what_study_designs_should_be_included_in_an_epoc_review.pdf.
14. Moher D, Liberatia A, Tetzlaff J, Altman D. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 2009;6(7).
15. Smith S. Interventions for improving outcomes in patients with multimorbidity in primary care and community settings - Smith, SM - 2016 | Cochrane Library. Cochrane Library of Systematic Reviews. 2016.
16. Butler DC, Petterson S, Phillips RL, Bazemore AW. Measures of social deprivation that predict health care access and need within a rational area of primary care service delivery. Health services research. 2013;48(2 Pt 1):539-59.
17. Smith SM, Wallace E, Salisbury C, Sasseville M, Bayliss E, Fortin M. A Core Outcome Set for Multimorbidity Research (COSmm). Ann Fam Med. 2018;16(2):132-8.

18. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ. 2008;337.
19. Cochrane. Cochrane Effective Practice and Organisation of Care (EPOC) Resources for review authors 2017 [Available from: epoc.cochrane.org/resources/epoc-resources-review-authors.
20. GRADE. Grade Working Group 2019 [Available from: http://www.gradeworkinggroup.org/.
21. Clarke M, Clarke SJ, Jagger C. Social Intervention and the Elderly:A Randomized Controlled Trial. American Journal of Epidemiology. 1992;136(12):1517-23.
22. Grant C, Goodenough T, Harvey I, Hine C. A randomised controlled trial and economic evaluation of a referrals facilitator between primary care and the voluntary sector. BMJ. 2000;320.
23. Kangovi S, Mitra N, Grande D, Huo H, Smith RA, Long JA. Community Health Worker Support for Disadvantaged Patients With Multiple Chronic Diseases: A Randomized Clinical Trial. Am J Public Health. 2017;107(10):1660-7.
24. Kangovi S, Mitra N, Norton L, Harte R, Zhao X, Carter T, et al. Effect of Community Health Worker Support on Clinical Outcomes of Low-Income Patients Across Primary Care Facilities: a Randomized Clinical Trial. JAMA internal medicine. 2018;178(12):1635-43.
25. Dickens AP, Richards SH, Hawton A, Taylor RS, Greaves CJ, Green C, et al. An evaluation of the effectiveness of a community mentoring service for socially isolated older people: a controlled trial. BMC public health. 2011;11:218-.
26. Mercer SW, Fitzpatrick B, Grant L, Chng NR, McConnachie A, Bakhshi A, et al. Effectiveness of Community-Links Practitioners in Areas of High Socioeconomic Deprivation. Ann Fam Med. 2019;17(6):518-25.
27. Carnes D, Sohanpal R, Frostick C, Hull S, Mathur R, Netuveli G, et al. The impact of a social prescribing service on patients in primary care: a mixed methods evaluation. BMC Health Services Research. 2017;17:1-9.
28. Kangovi S, Mitra N, Grande D, Long JA, Asch DA. Evidence-Based Community Health Worker Program Addresses Unmet Social Needs And Generates Positive Return On Investment. Health Affairs. 2020;39(2):207-13.
29. Kangovi S, Carter T, Charles D, Smith RA, Glanz K, Long JA, et al. Toward A Scalable, Patient-Centered Community Health Worker Model: Adapting the IMPaCT Intervention for Use in the Outpatient Setting. Popul Health Manag. 2016;19(6):380-8.
30. Reinhardt GY, Vidovic D, Hammerton C. Understanding loneliness: a systematic review of the impact of social prescribing initiatives on loneliness. Perspectives in Public Health. 2021;141(4):204-13.
31. Salisbury C, Man MS, Bower P, Guthrie B, Chaplin K, Gaunt DM, et al. Management of multimorbidity using a patient-centred care model: a pragmatic cluster-randomised trial of the 3D approach. Lancet. 2018;392(10141):41-50.
32. Dowrick C. Patient-centred care for multimorbidity: an end in itself? Lancet. 2018;392(10141):4-5.
33. Thomas G, Lynch M, Spencer LH. A Systematic Review to Examine the Evidence in Developing Social Prescribing Interventions That Apply a Co-Productive, Co-Designed Approach to Improve Well-Being Outcomes in a Community Setting. International journal of environmental research and public health. 2021;18(8):3896.
34. Maughan DL, Patel A, Parveen T, Braithwaite I, Cook J, Lillywhite R, et al. Primary-care-based social prescribing for mental health: an analysis of financial and environmental sustainability. Prim Health Care Res Dev. 2016;17(2):114-21.
35. Foster A, Thompson J, Holding E, Ariss S, Mukuria C, Jacques R, et al. Impact of social prescribing to address loneliness: A mixed methods evaluation of a national social prescribing programme. Health & Social Care in the Community. 2021;29(5):1439-49.
36. Embick ER, Maeng DD, Juskiewicz I, Cerulli C, Crean HF, Wittink M, et al. Demonstrated health care cost savings for women: findings from a community health worker intervention designed to address depression and unmet social needs. Archives of women's mental health. 2020.

37. Costa A, Sousa C, Seabra PRC, Virgolino A, Santos O, Lopes J, et al. Effectiveness of Social Prescribing Programs in the Primary Health-Care Context: A Systematic Literature Review. . Sustainability 2021;13(2731).
38. Kiely B CA, O'Shea E et al. . Effectiveness of link workers providing social prescribing on health outcomes and costs for adult patients in primary care and community settings. A protocol for a systematic review of the literature. [version 2; peer review: 2 approved]. . HRB Open Res 2020;2(21).
39. Kiely B, Clyne B, Boland F, Donnell P, Connolly D, Shea E, et al. Link workers providing social prescribing and health and social care coordination for people with multimorbidity in socially deprived areas (the LinkMM trial): protocol for a pragmatic randomised controlled trial. BMJ Open. 2021;11(2):e041809.
40. NHS. NHS Long Term Plan: NHS; 2019 [Available from: https://www.longtermplan.nhs.uk.
41. HSE. HSE Social Prescribing Framework 2021 [Available from: https://www.hse.ie/eng/about/who/healthwellbeing/our-priority-programmes/mental-health-and-wellbeing/hse-social-prescribing-framework.pdf.
42. HSE. Building the capacity for the evaluation of social prescribing. Evaluability assessment. : HSE; 2020 [Available from: https://www.hse.ie/eng/about/who/healthwellbeing/our-priority-programmes/mental-health-and-wellbeing/building-capacity-for-the-evaluation-of-social-prescribing-evaluability-assessment.pdf.
43. Tierney S, Mahtani KR. Understanding the implementation of link workers in primary care: A realist evaluation to inform current and future policy: NIHR; 2021 [Available from: https://fundingawards.nihr.ac.uk/award/NIHR130247.
44. Hibbard JH, Stockard J, Mahoney ER, Tusler M. Development of the Patient Activation Measure (PAM): conceptualizing and measuring activation in patients and consumers. Health services research. 2004;39(4 Pt 1):1005-26.
45. Gusi N, Olivares PR, Rajendram R. The EQ-5D Health-Related Quality of Life Questionnaire. In: Preedy VR, Watson RR, editors. Handbook of Disease Burdens and Quality of Life Measures. New York, NY: Springer New York; 2010. p. 87-99.
46. Fortin M, Stewart M, Ngangue P, Almirall J, Bélanger M, Brown JB, et al. Scaling Up Patient-Centered Interdisciplinary Care for Multimorbidity: A Pragmatic Mixed-Methods Randomized Controlled Trial. Ann Fam Med. 2021;19(2):126-34.
47. Al-Janabi H, N Flynn T, Coast J. Development of a self-report measure of capability wellbeing for adults: the ICECAP-A. Quality of Life Research. 2012;21(1):167-76.
48. NICE. Developing NICE Guidelines: the manual London: National Institute for Health and Care Excellence; 2014 [updated 15/10/2020. Available from: https://www.nice.org.uk/process/pmg20/chapter/incorporating-economic-evaluation.
49. Schünemann HJ, Cuello C, Akl EA, Mustafa RA, Meerpohl JJ, Thayer K, et al. GRADE guidelines: 18. How ROBINS-I and other tools to assess risk of bias in nonrandomized studies should be used to rate the certainty of a body of evidence. Journal of clinical epidemiology. 2019;111:105-14.

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources



* Including *Central Registry of Clinical Trials, Clinical Trials.gov and WHO International Clinical Trials Registry Platform ICTRP. EU Clinical Trials registry search returned no results*

Random sequence generation	
Allocation concealment	
Baseline outcome measurements similar	
Baseline characteristics similar	
Incomplete outcome data	
Knowledge of the allocated interventions adequately prevented	
Protection against contamination	
Selective outcome reporting	
Other risks of bias	

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 9
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 9
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 10
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 10
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 8
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 10
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 10
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 20
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 10
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 10
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 10
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 10

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 10
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 11
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 25
Study characteristics	17	Cite each included study and present its characteristics.	Page 15
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 17 and extended data
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3, Page 20 and see extended data
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 18, Summary of findings table
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Page 18
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Page 18 and see extended data GRADE assessment tables
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 23
	23b	Discuss any limitations of the evidence included in the review.	Page 25

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
	23c	Discuss any limitations of the review processes used.	Page 25
	23d	Discuss implications of the results for practice, policy, and future research.	Page 26
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 3
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 25
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	
Competing interests	26	Declare any competing interests of review authors.	
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Pubmed Search Strategy for “Effectiveness of link workers providing social prescribing on health outcomes and costs for adult patients in primary care and community settings. A protocol for a systematic review of the literature”

Query	Items found
Search ((((((((((("wellbeing program*"[Title/Abstract]) OR "community health advisor"[Title/Abstract]) OR "lay health worker*"[Title/Abstract]) OR "community facilitator"[Title/Abstract]) OR community navigator) OR "patient navigator"[Title/Abstract]) OR "link-worker"[Title/Abstract]) OR (("linkworker" OR "link worker" OR "link-worker"))) OR "social prescrib*") OR "community health worker"[Title/Abstract]) OR "community referral"[Title/Abstract]) Sort by: [pubsolr12]	6934
Search "wellbeing program*"[Title/Abstract] Sort by: [pubsolr12]	25
Search "community health advisor"[Title/Abstract] Sort by: [pubsolr12]	23
Search "lay health worker*"[Title/Abstract] Sort by: [pubsolr12]	332
Search "social referral"[Title/Abstract] Schema: all Sort by: [pubsolr12]	0
Search ("non medical referral"[Title/Abstract] OR "non-medical referral"[Title/Abstract]) Sort by: [pubsolr12]	0
Search "community facilitator"[Title/Abstract] Sort by: [pubsolr12]	7
Search community navigator Sort by: [pubsolr12]	5275
Search "community navigator"[Title/Abstract] Sort by: [pubsolr12]	0
Search "patient navigator"[Title/Abstract] Sort by: [pubsolr12]	247
Search ("well-being coordinator"[Title/Abstract] OR "wellbeing coordinator"[Title/Abstract]) Sort by: [pubsolr12]	0
Search "link-worker"[Title/Abstract] Sort by: [pubsolr12]	29
Search "link worker"[Title/Abstract] Sort by: [pubsolr12]	29
Search ("linkworker" OR "link worker" OR "link-worker") Sort by: [pubsolr12]	39
Search "social prescrib*" Sort by: [pubsolr12]	79
Search "social prescrib*"[Title/Abstract] Sort by: [pubsolr12]	79
Search "community health worker"[Title/Abstract] Sort by: [pubsolr12]	1052
Search "focused care worker"[Title/Abstract] Sort by: [pubsolr12]	0
Search "community referral"[Title/Abstract] Sort by: [pubsolr12]	89

Table 2 Public Patient Involvement reported according to Guidance for Reporting Involvement of Patients and the Public (GRIPP) 2 Short Form

1: Aim
The aim of the PPI was to provide the perspective of people living with multimorbidity on the implications of the results of a systematic review on the effectiveness of social prescribing link workers.
2: Methods
An advisory panel of six people living with multimorbidity was recruited via existing networks of students on a PhD program in multimorbidity. The panel meets quarterly to provide input on issues brought to them by the PhD students. The members are voluntary but receive a voucher to acknowledge their time and associated costs attending. The panel had been meeting for three years prior to providing input on this study. The meeting at which this study was discussed took place online, lasted two hours in total including a break and was facilitated by BK and 2 other PhD students on the multimorbidity PhD program. There was one hour dedicated to discuss the systematic review with them. The group received a 500 word plain language summary of the findings of the systematic review one week in advance of the meeting. BK also summarised the methods and findings in a powerpoint presention during the meeting. The group divided into small groups and discussed the implications for practice, policy and future research and fed back to a plenary discussion afterwards.
3: Study results
The group were surprised about the limited evidence and wondered if the outcomes had been appropriate or asked in the right way. They agreed that quality of life was a good overall outcome and felt hospitalisations would matter from the taxpayer perspective. Determining a set of outcomes was felt to be beyond the time available and we agreed it would involve a separate piece of research work. As individuals they did not feel that social prescribing needed to be presented as an experimental intervention, as many interventions or medications may not work for an individual and they felt their healthcare provider would recommend what they thought might work for them, but acknowledged this wasn't guaranteed in the case of social prescribing. They felt policy makers should roll social prescribing out on a pilot basis over a number of years and evaluate it along the way. In terms of targeting specific groups the PPI group felt that social prescribing should be available to whoever might need it, but that it would have to be flexible to allow longer support for those with more complex needs.

Table 2 Public Patient Involvement reported according to Guidance for Reporting Involvement of Patients and the Public (GRIPP) 2 Short Form

4: Discussion and conclusions
The group clearly came to the meeting with a positive perception of social prescribing and felt it was a great idea that should be tested. Despite this possible lack of objectivity, the group broadly agreed with the conclusions that the research team had made. Their input highlighted the need for a set of core outcomes for social prescribing with input from potential beneficiaries. They took a more flexible approach on recommendations around specific target groups and intervention intensity, preferring an individually tailored intervention rather than limit access to those with the highest need.
5: Reflections/critical perspective
While the lack of cost effectiveness evidence was highlighted the idea of opportunity cost was not discussed. Presenting an intervention with no cost evidence base against one with cost evidence base however would be an impossible comparison. It is hard in a group format to check understanding of what has been presented, but given that conclusions were aligned with those of the research team it is reasonable to assume the group understood what was presented and asked of them.

HRQOL Allocation concealment	Baseline outcome measurements similar	Baseline characteristics similar	Incomplete outcome data	Knowledge of the allocated interventions adequately prevented during the study	Protection against contamination	Selective outcome reporting	Other risks of bias	Overall Judgement per study	Overall judgement for outcome
Score "Low risk" if the unit of allocation was by institution, team or professional and allocation was performed on all units at the start of the study; or if the unit of allocation was by patient or episode of care and there was some form of centralised randomisat	Score "Low risk" if performance or patient outcomes were measured prior to the intervention, and no important differences were present across study groups. In randomised trials, score "Low risk" if imbalanced but appropriate adjusted analysis was performed (e.g.	Score "Low risk" if baseline characteristics of the study and control providers are reported and similar.	Score "Low risk" if missing outcome measures were unlikely to bias the results (e.g. the proportion of missing data was similar in the intervention and control groups or the proportion of missing data was	Score "Low risk" if the authors state explicitly that the primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay. Primary outcomes are those variables that correspond to the primary hypothesis or question as defined by the authors.	Score "Low risk" if allocation was by community, institution or practice and it is unlikely that the control group received the intervention.	Score "Low risk" if there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section).		See Table 8.7.a of EPOC summary risk of bias for guidance	See Table 8.7.a of EPOC summary risk of bias for guidance

ion scheme, an on-site computer system or sealed opaque envelopes were used.	Analysis of covariance).		less than the effect size i.e. unlikely to overturn the study result)			
Controlled before-after studies should be scored "High risk"	Score "High risk" if important differences were present and not adjusted for in analysis.	Score "High risk" if there is no report of characteristics in text or tables or if there are differences between control and intervention providers. Note that in some cases imbalance in patient characteristics may be due to	Score "High risk" if missing outcome data was likely to bias the results	Score "High risk" if the outcomes were not assessed blindly.	Score "High risk" if it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised).	Score "High risk" if some important outcomes are subsequently omitted from the results.

		recruitment bias whereby the provider was responsible for recruiting patients into the trial.				
. Score "Unclear risk" if not specified in the paper.	If randomised trials have no baseline measure of outcome, score "Unclear risk".	Score "Unclear risk" if it is not clear in the paper (e.g. characteristics are mentioned in text but no data were presented).	Score "Unclear risk" if not specified in the paper (Do not assume 100% follow up unless stated explicitly).	Score "Unclear risk" if not specified in the paper	Score "Unclear risk" if professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professionals could have occurred (e.g. physicians within practices	Score "Unclear risk" if not specified in the paper. For further information see Chapter 13 of the Cochrane handbook: Assessing risk of bias due to missing results in a synthesis.

					were allocated to intervention or control)			
Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: there were slighly more participants of hispanic ethnicity in one arm-0 vs 3.7%	Low risk: 79% ad 81% f/up in int and control and multiple imputation techniques used for missing data	Unclear risk: not possible to blind to intervention and outcome was patient reported, although RAs collecting data were blinded	Unclear risk: randomisation was at the patient level, however unlikely controls received the intervention, but not explicitedly stated whether intervention was avaialble outside the trial setting	Low risk: all outcomes are reporoted	Unclear:The authors offer commerical consulting services on setting up similar CHW interventions since 2018 after this publication	Low risk: low risk of bias in 6/9 areas, and other areas unlikely to have significant impact on ROB. While the paper is at risk of overly presenting positive fidnings all outcomes are reported

								along with statistical significance.	
Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: Intervention group were more likely to be empolyed 20% vs 8%	Low risk: 88% and 87% complete data, multiple imputation	Unclear risk: not possible to blind to intervention and outcome was patient reported, although RAs collecting data were blinded	Unclear risk: randomisation was at the patient level, however unlikely they received controls received the intervention, so not a major factor for overall ROB	Low risk: all outcomes are reported	Unclear- The authors offer commerical consulting services on setting up similar CHW interventions	Low risk: low risk of bias in 6/9 areas, and other areas unlikely to have significant impact on ROB. While the paper is at risk of overly presenting positive fidnings all outcomes are reported along with statistical	Summary Judgement RCTs: Low risk of bias

								significance.
High risk: CBA and evidence of selection bias with those from more deprived backgrounds not being offered entry	Low risk: significant differences in baseline scores, although linear regression model used which would have corrected for baseline scores	High risk: differences in basleine characteristics although these were adjusted for in analysis	Low risk: low rates of missing data, 84% follow up intervention and 93% control and did separate paired and unpaired analysis	Unclear risk- unclear how follow up assessments were done, by whom and if blinded	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Devon, no competing interests declared.	High risk: high risk or unclear risk in 4 of 9 areas
High risk: CBA and evidence of selection bias with those from more deprived backgrounds not being	Low risk: significant differences in baseline scores, although linear regression model used which	High risk: differences in basleine characteristics although these were adjusted for in analysis	Low risk: low rates of missing data, 84% follow up intervention and 96% control	Unclear risk- unclear how follow up assessments were done, by whom and if blinded	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Devon, no competing interests declared.	High risk: high risk or unclear risk in 4 of 9 areas

offered entry	would have corrected for baseline scores								
Unclear risk: practices randomly assigned but how not stated	Low risk: significant differences in baseline-explicitly corrected for in analysis	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: 76% follow up int, 92% control, ITT analysis	High risk: due to the nature of the intervention not possible to assess outcomes blindly	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Scotland, no competing interests declared.	Unclear or High risk of bias in 4 of 9 areas	Summary Judgement NRCTS: High risk of Bias due to non randomised design and challenge of finding suitable controls.

Mental Health

Allocation concealment	Baseline outcome measurements similar	Baseline characteristics similar	Incomplete outcome data	Knowledge of the allocated interventions adequately prevented during the study	Protection against contamination	Selective outcome reporting	Other risks of bias	Overall Judgement per study	Overall judgement for outcome

Score “Low risk” if the unit of allocation was by institution, team or professional and allocation was performed on all units at the start of the study; or if the unit of allocation was by patient or episode of care and there was some form of centralised randomisation scheme, an on-site computer system or sealed	Score “Low risk” if performance or patient outcomes were measured prior to the intervention, and no important differences were present across study groups. In randomised trials, score “Low risk” if imbalanced but appropriate adjusted analysis was performed (e.g. Analysis of covariance).	Score “Low risk” if baseline characteristics of the study and control providers are reported and similar.	Score “Low risk” if missing outcome measures were unlikely to bias the results (e.g. the proportion of missing data was similar in the intervention and control groups or the proportion of missing data was less than the effect size i.e. unlikely to overturn the study result)	Score “Low risk” if the authors state explicitly that the primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay. Primary outcomes are those variables that correspond to the primary hypothesis or question as defined by the authors.	Score “Low risk” if allocation was by community, institution or practice and it is unlikely that the control group received the intervention.	Score “Low risk” if there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section).	See Table 8.7.a of EPOC summary risk of bias for guidance	See Table 8.7.a of EPOC summary risk of bias for guidance

opaque envelopes were used.						
Controlled before-after studies should be scored “High risk”	Score “High risk” if important differences were present and not adjusted for in analysis.	Score “High risk” if there is no report of characteristics in text or tables or if there are differences between control and intervention providers. Note that in some cases imbalance in patient characteristics may be	Score “High risk” if missing outcome data was likely to bias the results	Score “High risk” if the outcomes were not assessed blindly.	Score “High risk” if it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised).	Score “High risk” if some important outcomes are subsequently omitted from the results.

		due to recruitment bias whereby the provider was responsible for recruiting patients into the trial.				
. Score "Unclear risk" if not specified in the paper.	If randomised trials have no baseline measure of outcome, score "Unclear risk".	Score "Unclear risk" if it is not clear in the paper (e.g. characteristics are mentioned in text but no data were presented).	Score "Unclear risk" if not specified in the paper (Do not assume 100% follow up unless stated explicitly).	Score "Unclear risk" if not specified in the paper	Score "Unclear risk" if professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professionals could have occurred (e.g. physicians	Score "Unclear risk" if not specified in the paper. For further information see Chapter 13 of the Cochrane handbook: Assessing risk of bias due to missing results in a synthesis.

					within practices were allocated to intervention or control)				
Low risk: sealed opaque envelopes, while there was an early error- this was identifed and those participants excluded	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no impact on reuslts when adjusted for in analysis	Low risk: similar amounts of missing data in both arms, at 67%, however this reduced power to detect a difference as required sample size was 161	High risk: due to the nature of the intervention not possible to blind participants and self reported outcome	Unclear risk: randomisation was at the patient level within practices, unclear if the intervention was availale outside the trial- suggestion it was already running, so people may have received it before entering the trial	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health autothirty, no competing interests declared.	Low risk: low risk in 7 of 9 areas, blinding very challenging given nature of intervention and were using validated PROMs	Summary Judgement RCTs: low risk of bias

High risk: CBA	Low risk: significant differences in baseline scores, althouhg linear regression model used which would have corrected for baseline scores	High risk: significant differences in living arrnagement, education, work status, adjustments for same did not significantly alter results, suggesting other unknown imbalances	High risk: control follow up 43%, int 35%, no data on whether those LTFup had different baseline characteristics	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by DoH, independent research group, no competing interests declared.	High risk: high risk in 5 of 9 areas
High risk: CBA and evidence of selection bias with those from more deprived backgrounds not being offered entry	Low risk: significant differences in baseline scores, although linear regression model used which would have corrected for baseline scores	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: low rates of missing data, 84% follow up intervention and 96% control	Unclear risk: due to the nature of the intervention not possible to blind participants and unclear how follow up collected	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Hackney CCG, no competing interests declared.	High risk: high risk or unclear risk in 4 of 9 areas

Unclear risk: practices randomly assigned but how not stated	Low risk: significant differences in baseline- explicitly corrected for in analysis	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: 76% follow up int, 92% control	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported, statisticians were blinded	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Scotland, no competing interests declared.	High or unclear risk of bias in 4 of 9 areas	Summary Judgement nRCTS: high risk of bias due to difficulty in concealing allocation, baseline differences in control groups, non randomised design

Social Contacts

Score “Low risk” if a random component in the sequence generation process is described (e.g. Referring to a random number table).	Score “Low risk” if the unit of allocation was by institution, team or professional and allocation was performed on all units at the start of the study; or if the unit of allocation was by patient or episode of care and there was some form of centralised randomisation scheme, an on-site computer system or sealed opaque	Score “Low risk” if performance or patient outcomes were measured prior to the intervention, and no important differences were present across study groups. In randomised trials, score “Low risk” if imbalanced but appropriate adjusted analysis was performed (e.g.	Score “Low risk” if baseline characteristics of the study and control providers are reported and similar.	Score “Low risk” if missing outcome measures were unlikely to bias the results (e.g. the proportion of missing data was similar in the intervention and control groups or the proportion of missing data was less than the effect size i.e. unlikely to overturn	Score “Low risk” if the authors state explicitly that the primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay. Primary outcomes are those variables that correspond to the primary hypothesis or question as defined by the authors.	Score “Low risk” if allocation was by community, institution or practice and it is unlikely that the control group received the intervention.	Score “Low risk” if there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section).	See Table 8.7.a of EPOC summary risk of bias for guidance	See Table 8.7.a of EPOC summary risk of bias for guidance

	envelopes were used.	Analysis of covariance).	the study result)				
Score “High risk” when a nonrandom method is used (e.g. performed by date of admission). Non-randomised trials and controlled before-after studies should be scored “High risk”.	Controlled before-after studies should be scored “High risk”	Score “High risk” if important differences were present and not adjusted for in analysis.	Score “High risk” if there is no report of characteristics in text or tables or if there are differences between control and intervention providers. Note that in some cases imbalance in patient characteristics may be due to recruitment	Score “High risk” if missing outcome data was likely to bias the results	Score “High risk” if the outcomes were not assessed blindly.	Score “High risk” if it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised).	Score “High risk” if some important outcomes are subsequently omitted from the results.

			bias whereby the provider was responsible for recruiting patients into the trial.				
Score "Unclear risk" if not specified in the paper.	. Score "Unclear risk" if not specified in the paper.	If randomised trials have no baseline measure of outcome, score "Unclear risk".	Score "Unclear risk" if it is not clear in the paper (e.g. characteristics are mentioned in text but no data were presented).	Score "Unclear risk" if not specified in the paper (Do not assume 100% follow up unless stated explicitly).	Score "Unclear risk" if not specified in the paper	Score "Unclear risk" if professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professionals could have occurred (e.g. physicians within practices	Score "Unclear risk" if not specified in the paper. For further information see Chapter 13 of the Cochrane handbook: Assessing risk of bias due to missing results in a synthesis.

						were allocated to intervention or control)			
Unclear risk- register of all >75s living alone compiled and arranged into deciles by social contact score and randomly allocated into control and experimental arms- how randomised not specified	Unclear risk- Method of randomisation not sepcified	Low risk- reported and no signficant differences in baseline outcomes	High risk- characterisitics such as age, gender, education etc not reported, only baseline outcome measures referred to as characteristics	Low risk- similar loss to follow up in both arms, with reasons	Unclear risk- participants would be aware of their allocation, although interview assesors were blinded	Low risk- while randomised at patient level it seems very unlikely control group would have recived intervention as it was not available other than through the trial	Low risk- all outcomes reported in baseline were reported at follow up	Low risk- pulicly funded, no competing interests declared	Low risk- while some areas unclear due to lack of reporting, unlikely to affect outcome, low risk in 5 of 9 areas

Low risk: Sequenced numbered envelopes prepared by research team, block randomisation	Low risk: sealed opaque envelopes, howevere reported that there were isssues in ealr y stages and some patients excluded	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no impact on reuslts when adjusted for in analysis	Low risk: similar amounts of missing data in both arms, at 67%, however this reduced power to detect a difference as required sample size was 161	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Unclear risk: randomisation was at the patient level within practices, unclear if the intervention was running in the local area so possible patients could have accessed it outside the trial	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health autothirty, no competing interests declared.	Low risk: low risk in 7 of 9 areas	Low risk: Both RCTs mainly low risk- risks arise from poor reporting and nature of interventi on
High risk: controlled before after study	High risk: CBA and evidence of selection bias with those from more deprived backgrounds not being offered entry	Low risk: significant differences in baseline scores, although linear regression model used which would have	High risk: differences in basleine characteristics although these were adjusted for in analysis	Low risk: low rates of missing data, 84% follow up interventi on and 96% control	Unclear risk: due to the nature of the intervention cannot blind participants and not stated how outcomes were assessed	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Scotland, no competing interests	High risk: high or unclear risk in 4 of 9 areas	High risk: only one CBA and it is at high risk of bias

		corrected for baseline scores				declared .		
							Overall:	Low risk: Evidence from two RCTs

Physical Activity

Score “Low risk” if a random component in the sequence generation process is described (e.g. Referring to a random number table).	Score “Low risk” if the unit of allocation was by institution, team or professional and allocation was performed on all units at the start of the study; or if the unit of allocation was by patient or episode of	Score “Low risk” if performance or patient outcomes were measured prior to the intervention, and no important differences were present across study groups. In	Score “Low risk” if baseline characteristics of the study and control providers are reported and similar.	Score “Low risk” if missing outcome measures were unlikely to bias the results (e.g. the proportion of missing data was similar in the intervention and control groups or the proportion	Score “Low risk” if the authors state explicitly that the primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay. Primary outcomes are those variables that correspond to the primary hypothesis or question as defined by the authors.	Score “Low risk” if allocation was by community, institution or practice and it is unlikely that the control group received the intervention .	Score “Low risk” if there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section).	See Table 8.7.a of EPOC summary risk of bias for guidance	See Table 8.7.a of EPOC summary risk of bias for guidance

	care and there was some form of centralised randomisation scheme, an on-site computer system or sealed opaque envelopes were used.	randomised trials, score "Low risk" if imbalanced but appropriate adjusted analysis was performed (e.g. Analysis of covariance).		of missing data was less than the effect size i.e. unlikely to overturn the study result)			
Score "High risk" when a nonrandom method is used (e.g. performed by date of admission). Non-randomised trials and controlled before-after	Controlled before-after studies should be scored "High risk"	Score "High risk" if important differences were present and not adjusted for in analysis.	Score "High risk" if there is no report of characteristics in text or tables or if there are differences between control and intervention providers. Note that in some cases	Score "High risk" if missing outcome data was likely to bias the results	Score "High risk" if the outcomes were not assessed blindly.	Score "High risk" if it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised).	Score "High risk" if some important outcomes are subsequently omitted from the results.

studies should be scored "High risk".			imbalance in patient characteristics may be due to recruitment bias whereby the provider was responsible for recruiting patients into the trial.				
Score "Unclear risk" if not specified in the paper.	. Score "Unclear risk" if not specified in the paper.	If randomised trials have no baseline measure of outcome, score "Unclear risk".	Score "Unclear risk" if it is not clear in the paper (e.g. characteristics are mentioned in text but no data were presented).	Score "Unclear risk" if not specified in the paper (Do not assume 100% follow up unless stated explicitly).	Score "Unclear risk" if not specified in the paper	Score "Unclear risk" if professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professional	Score "Unclear risk" if not specified in the paper. For further information see Chapter 13 of the Cochrane handbook: Assessing risk of bias due to

						s could have occurred (e.g. physicians within practices were allocated to intervention or control)	missing results in a synthesis.		
Unclear risk- register of all >75s living alone compiled and arranged into deciles by cosial contact score and randomly allocated into control and experimental arms- how randomised not specified	Unclear risk- Method of randomisation not sepcified	Low risk- reported and no signficant differences in baseline outcomes	High risk- characterisitics such as age, education etc not reported, only baseline outcome measures referred to as characteristics	Low risk- similar loss to follow up in both arms, with reasons	Unclear risk- participants would be aware of their allocation, although interview assesors were blinded	Low risk- while randomised at patient level it seems very unlikely control group would have recived intervention as it was not available other than through the trial	Low risk- all outcomes reported in baseline were reported at follow up	Low risk- pulicly funded, no competing interests declared	Low risk- while some areas unclear due to lack of reporting, unlikely to affect outcome, low risk in 5 of 9 areas

Low risk: Sequenced numbered envelopes prepared by research team, block randomisation	Low risk: sealed opaque envelopes	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no impact on reuslts when adjusted for in analysis	Low risk: similar amounts of missing data in both arms, at 67%, however this reduced power to detect a difference as required sample size was 161	Unclear risk: due to the nature of the intervention not possible to blind participants but assessors blinded	Unclear risk: randomisation was at the patient level within practices, unclear if it participants could self refer to the project which was running in the local area	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health autothirty, no competing interests declared.	Low risk: low risk in 7 of 9 areas	Overall RCTs:Low risk, most evidence comes from RCTs at low risk of bias
High risk: controlled before after study	High risk: CBA	low risk: significant differences in baseline scores, althouhg linear regression model used which would have corrected for	High risk: significant differences in living arrangement, education, work status, adjustments for same did not significantly alter results, suggesting	High risk: control follow up 43%, int 35%, no data on whether those LTFup had different baseline characteristics	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by DoH, independent research group, no competing interests declared.	High risk: high risk in 5 of 9 areas	

		baseline scores	other unknown imbalances							
High risk: controlled before after study	Unclear risk: practices randomly assigned but how not stated	Low risk: significant differences in baseline- explicitly corrected for in analysis	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: 76% follow up int, 92% control	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Hackney CCG, no competing interests declared.	High risk: High or unclear risk in 4 of 9 areas	Overall nRCTs: High Risk: One study at very high risk of bias and one at high risk of bias
										Overall: High risk due to inclusion of CBAs, without these low risk, altohugh some concerns about allocation concealment that is inherent

									to the interventi on

Health Care Utilisation

Score “Low risk” if a random component in the sequence generation process is described (e.g. Referring to a random number table).	Score “Low risk” if the unit of allocation was by institution, team or professiona l and allocation was performed on all units at the start of the study; or if the unit of allocation was by patient or episode of care and there was some form	Score “Low risk” if performa nce or patient outcomes were measured prior to the interventi on, and no important differences were present across study groups. In randomis ed trials, score	Score “Low risk” if baseline characterist ics of the study and control providers are reported and similar.	Score “Low risk” if missing outcome measures were unlikely to bias the results (e.g. the proportio n of missing data was similar in the interventi on and control groups or the proportio	Score “Low risk if the authors state explicitly that the primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay. Primary outcomes are those variables that correspond to the primary hypothesis or question as defined by the authors.	Score “Low risk” if allocation was by community, institution or practice and it is unlikely that the control group received the intervention .	Score “Low risk” if there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section).	See Table 8.7.a of EPOC summary risk of bias for guidance	See Table 8.7.a of EPOC summa ry risk of bias for guidanc e

	of centralised randomisation scheme, an on-site computer system or sealed opaque envelopes were used.	"Low risk" if imbalanced but appropriate adjusted analysis was performed (e.g. Analysis of covariance).		n of missing data was less than the effect size i.e. unlikely to overturn the study result)			
Score "High risk" when a nonrandom method is used (e.g. performed by date of admission). Non-randomised trials and controlled before-after studies should be	Controlled before-after studies should be scored "High risk"	Score "High risk" if important differences were present and not adjusted for in analysis.	Score "High risk" if there is no report of characteristics in text or tables or if there are differences between control and intervention providers. Note that in some cases imbalance in patient characterist	Score "High risk" if missing outcome data was likely to bias the results	Score "High risk" if the outcomes were not assessed blindly.	Score "High risk" if it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised).	Score "High risk" if some important outcomes are subsequently omitted from the results.

scored "High risk".			ics may be due to recruitment bias whereby the provider was responsible for recruiting patients into the trial.				
Score "Unclear risk" if not specified in the paper.	. Score "Unclear risk" if not specified in the paper.	If randomised trials have no baseline measure of outcome, score "Unclear risk".	Score "Unclear risk" if it is not clear in the paper (e.g. characteristics are mentioned in text but no data were presented).	Score "Unclear risk" if not specified in the paper (Do not assume 100% follow up unless stated explicitly).	Score "Unclear risk" if not specified in the paper	Score "Unclear risk" if professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professionals could have occurred (e.g.	Score "Unclear risk" if not specified in the paper. For further information see Chapter 13 of the Cochrane handbook: Assessing risk of bias due to missing results in

						physicians within practices were allocated to intervention or control)	a synthesis.		
Unclear risk- register of all >75s living alone compiled and arranged into deciles by cosial contact score and randomly allocated into control and experimental arms- how randomised not specified	Unclear risk- Method of randomisation not sepcified	Low risk- reported and no signficant differences in baseline outcomes	High risk- characterisitics such as age, education etc not reported, only baseline outcome measures referred to as characteristics	Low risk- similar loss to follow up in both arms, with reasons	Low risk- participants would be aware of their allocation, although interview assesors were blinded. HCU was self reported to assessors	Low risk- while randomised at patient level it seems very unlikely control group would have recived intervention as it was not available other than through the trial	Low risk- all outcomes reporte din baseline were reported at follow up	Low risk- pulicly funded, no competing interests declared	Low risk- while some areas unclear due to lack of reporting, unlikely to affect outcome, low risk in 5 of 9 areas

Low risk: Sequenced numbered envelopes prepared by research team, block randomisation	Low risk: sealed opaque envelopes	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no impact on reuslts when adjusted for in analysis	Low risk: similar amounts of missing data in both arms, data on HCU available for 157	Unclear risk: not reported if outcome assessors were blinded or how health care utilisation data was obtained	Unclear risk: randomisation was at the patient level within practices. GPs were more interested in social interventions	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health autothirty, no competing interests declared.	Low risk: low risk in 7 of 9 areas
Low risk: conputerised generated algorithm with blocks, performed by study team member not assocaited with outcomes assessment	Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: there were slighly more participants of hispanic ethnicity in one arm-0 vs 3.7%	Low risk: 100% data available for health care utilisation	Low risk- Hospitalisation data from routine sources and assessors/statisticians were blinded.	Low risk: randomisation was at the patient level, however unlikely they received controls received the intervention, so not a major factor for overall ROB	Low risk: all outcomes are reporoted	The authors offer commerical consulting services on setting up similar CHW interventions	Low risk: low risk of bias in 7/9 areas, and other areas unlikely to have significant impact on ROB. While the paper is at risk of overly presenting positive fidnings all

								outcomes are reported along with statistical significance.	
Low risk: conputerised generated algorithm with blocks, performed by study team member not assocaited with outcomes assessment	Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: Intervention group were more likely to be empolyed 20% vs 8%	Low risk: 100% data available for health care utilisation	Low risk- Hospitalisation data from routine sources and assessors/statisticians were blinded.	High risk: randomisation was at the patient level, however unlikely they received controls received the intervention, so not a major factor for overall ROB	Low risk: all outcomes are reporoted	The authors offer commerical consulting services on setting up similar CHW interventions	Low risk- low risk 7/9 areas and other domains such as allocation inherent to nature of intervention or contamination due to patient level randomisation	Overall RCTs: Low risk of bias
High risk: controlled before after study	High risk: CBA	High risk: significant differences in baseline scores, and controls	High risk: significant differences in living arrnagement, education, work	Low risk: use of anonymised GP data meant no missing data	Low risk- anonymised data frm GP records	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by DoH, independent	High risk: high risk in 4 of 9 areas	Overall nRCTs: High risk of bias due to control mismat

	were drawn from same practice population , but not deemed suitable for referral (different to controls for other outcomes)	status, adjustments for same did not significantly alter results, suggesting other unknown imbalances		research group, no competing interests declared.		ch in particular
						Overall: Low risk of bias for RCTs, only 1 CBA at high risk

Summary of findings:

Social prescribing link workers compared to usual care for people with multimorbidity

Patient or population: people with multimorbidity

Setting: Primary Care

Intervention: social prescribing link workers

Comparison: usual care

Outcomes	Impact	№ of participants (studies)	Certainty of the evidence (GRADE)
Health related quality of life (RCTs) assessed with: SF-12 HRQoL measure follow-up: range 6 months to 9 months	Two RCTs reported no difference in the physical health component of the SF-12. One of these trials showed a postive impact on the mental health component of the SF-12 (2.3 vs -0.2 p= 0.008.), but the other showed no difference.	894 (2 RCTs)	⨁⨁◯◯ Low[a,b]
Health related quality of life (CBAs) assessed with: EQ-5D and SF-12 HRQoL measures follow-up: range 3 months to 9 months	One CBA reported no difference in the MCS or PCS of the SF-12. The same trial reported a small change in the EQ-5D-3L in favour of the control group (-0.09 (-0.14 to -0.03) p=<0.001). The second CBA found no difference in the EQ-5D-5L.	1292 (2 observational studies)	⨁◯◯◯ Very low[c]
Mental Health (RCTs) assessed with: Mental Health as assessed by the hospital anxiety depression scale follow-up: mean 4 months	One RCT found an improvement in the anxiety component of the HADS (-1.9 (-3.0 to -0.7)a p=0.002) , but not the depression component (-0.9 (-1.9 to 0.2) p=0.116)	152 (1 RCT)	⨁⨁◯◯ Low[d,e]
Mental Health (CBAs) assessed with: Mental health as assessed by a screening tool for mental illness follow-up: range 3 months to 9 months	One CBA reported no difference in the geriatric depression scale. Two CBAs found no difference in the HADS anxiety or depression scales.	1772 (3 observational studies)	⨁◯◯◯ Very low[f,g]
Social support and contacts (RCTs) follow-up: range 4 months to 24 months	One RCT of a two year intervention for people aged over 75 found no difference in Tunstalls social cotact score. One RCT of a one month intervention found no difference in Dukes Social Support Scale.	714 (2 RCTs)	⨁⨁◯◯ Low[h,i]
Social contacts and supports (CBAs) follow-up: mean 8 months	One CBA looked at social support as measured by the Medical outcomes survey: social support scale and found no difference.	392 (1 observational study)	⨁◯◯◯ Very low[j]
Self rated health (RCTs) follow-up: range 4 months to 24 months	Two RCTs examined self rated health. One using a simple scale reported a greater % improved in the intervention (20%) than control group (11%). The other used the WONCA-COOP functional health scale that includes a measure of overall health and found an improvement favouring the intervention group (-0.4 (-0.7 to -0.1) p=0.003).	734 (2 RCTs)	⨁⨁◯◯ Low[k,l]

Summary of findings:

Social prescribing link workers compared to usual care for people with multimorbidity

Patient or population: people with multimorbidity

Setting: Primary Care

Intervention: social prescribing link workers

Comparison: usual care

Outcomes	Impact	№ of participants (studies)	Certainty of the evidence (GRADE)
Self rated health (CBAs) assessed with: Likert scale from 1 (poorest health) to 5 (best health) follow-up: mean 8 months	One CBA examined self rated health and found no difference between groups. (0.127 (−0.221, 0.9475) p=not reported)	480 (1 observational study)	⨁◯◯◯ Very low[m]
Physical Activities (RCTs) assessed with: Any measurement of daily activities or exercise follow-up: range 4 months to 24 months	One RCT of 152 adults found an improvement in daily activities (Daily Activities -0.5 (-0.6 to -0.2) p=0.001) but no effect on physical fitness (-0.3 (-0.6 to 0.05) p=0.98). The other of a 2 year intervention in adults over 75 found no difference in activities of daily living.	712 (2 RCTs)	⨁◯◯◯ Very low[n,o,p]
Physical activities (CBAs) assessed with: Any measure of daily activities or exercise follow-up: mean 8.5 months	One CBA found no difference in self reported exercise. The other found a decrease in daily activities in the intervention group (-0.897 (-1.729 to -0.065) p=0.035).	1380 (2 observational studies)	⨁◯◯◯ Very low[q,r,s]
Hospitalisations (RCTs) assessed with: Number of hospital admissions and number of days hospitalised follow-up: range 9 months to 12 months	Two RCTs reported a decrease in hospitalisations in the intervention group. One found a reduction in days in hospital (300 days vs 471 days; absolute event rate reduction,65%) at nine months. The other reported a reducton in hospitalisations and hospital days in the intervention group-68 total hospitalizations (278 hospital days) versus 98 (414 hospital days) in the control group. Neither reached statistical significance.	894 (2 RCTs)	⨁⨁◯◯ Low[t,u]
Primary Care Utilisation (RCTs) follow-up: range 4 months to 24 months	Neither RCT found a difference between groups for contacts with the primary care team.	714 (2 RCTs)	⨁⨁◯◯ Low[v,w]
Primary Care Utilisation (CBAs) follow-up: mean 8 months	The authors reported a reduction in the number of primary care visits in the intervention group and an increase in the control group, but because of baseline imbalances in the groups it was difficult to attribute this change to the intervention.	480 (1 observational study)	⨁◯◯◯ Very low[x,y]

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

CI: confidence interval

Summary of findings:

Social prescribing link workers compared to usual care for people with multimorbidity

Patient or population: people with multimorbidity

Setting: Primary Care

Intervention: social prescribing link workers

Comparison: usual care

Outcomes	Impact	№ of participants (studies)	Certainty of the evidence (GRADE)

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. The two RCTs examined a similar intervention but found different results for the MCS of the SF-12

b. The two RCTs were conducted in a single health care setting and may not transfer to other healthcare settings

c. One RCT looked at a deprived population over nine months, the other looked at an older, less deprived population over three months

d. The population was less deprived than in other studies and the usual target populations for link worker interventions and the intervention was only one month long

e. The confidence interval for anxiety included a change that was clinically insignificant.

f. Risk of bias was high in one CBA due to missing data, baseline differences and in all due to blinding

g. One CBA looked at an older less deprived population over three months, while the other two included a more deprived younger population over eight to nine months

h. One study looked at a two year intervention in over 75s which would not be typical of link worker interventions. The other study looked at a less deprived population than usually targeted for link worker interventions

i. One study did not provide confidence intervals and the other had a small sample size.

j. The CBA looked at a less deprived population than usually targeted for link worker interventions.

k. One study looked at participants aged over 75 with an intervention duration of 2 years, whereas the other was in a younger, less deprived population and intervention was 4 months.

l. Studies used different measures, one being a subscale of the WONCA/COOP Functional Health questionnaire. One RCT had a small sample size of 152.

m. There were baseline differences between the intervention and control groups. There was a significant loss to follow up of almost 70%.

n. Studies used slightly different measures and had different findings

o. One study looked at a two year intervention and another at a one month intervention. Populations differed with one being adults over 75, older than the typical social prescribing population targeted and the other less deprived.

p. One study did not report any confidence interval so cannot assess imprecision

q. One CBA had baseline differences between the intervention and control group and significant loss to follow up of almost 70%.

r. Studies used different measures and had slightly different results.

s. One study did not provide confidence intervals so imprecision could not be assessed.

t. The two RCTs were conducted in a single healthcare setting and may not transfer to other settings. The intervention was also longer and more intense than other social prescribing interventions.

u. Neither study found a statistically significant reductions in hospitalisations or days in hospital but there was a trend towards significance.

v. One RCT looked at a two year intervention for the over 75s. The other looked at a younger less deprived population than usually targeted for social prescribing interventions.

w. Neither RCT reported confidence intervals or results of statitical analysis making it difficult to comment.

x. The CBA had baseline imbalances between groups and almost 70% loss to follow up

y. The baseline attendance rates between the two groups were very different and fidnings liekly reflect regression to the mean.

Study ID	Primary Outcomes: Results	Secondary Outcomes: Results
Clarke et al, RCT 19	Survival (% at 3.5 years) 73% in Intervention vs. 78% in control. Reported as non-significant.	Activities of daily living, loneliness (Wenger scale), morale (Geriatric Morale Scale), social contact score (Tunstall): no significant changes at 2 years. Information orientation score: not reported. Self-perceived health (% improved): 20% Intervention, 11% Control - reported as significant. HCU: 17% and 12% of both groups had seen GP and PHN respectively in previous month - reported as non-significant.
Grant et al	Mental Health: Anxiety (HADS-A) -1.9 (-3.0 to -0.7)[a] p=0.002, Depression (HADS-D) -0.9 (-1.9 to 0.2) p=0.116. Social Support (Dukes Social Support Scale): Confidant -0.9 (-2.4 to 0.6) p=0.221, Affective -0.3 (-1.2 to 0.7) p=0.594	Quality of life (delighted terrible faces scale): - 0.5 (-0.9 to -0.1) p=0.006. Functional health (COOP/WONCA functional health assessment scale): Pain -0.5 (-0.8 to -0.1), Physical fitness -0.3 (-0.6 to 0.05) p=0.98, Feelings -0.5, (-0.8 to -0.2), Daily Activities -0.5 (-0.6 to -0.2) p=0.001, Social Activities -0.3 (-0.6 to 0.1) p=0.196, Change in health -0.3 (-0.6 to -0.03) p=0.03, Overall Health -0.4 (-0.7 to -0.1) p=0.003. HCU: both groups had similar contacts with the PCT, but the intervention group were reported as having more prescriptions, including mental health prescriptions and fewer referrals to general and mental health services, although no statistical analysis was performed.
Kangovi et al, 2018	Health Related Quality of Life (HRQoL), Physical Health Component (SF-12-V2 PCS) -0.7 (-2.2 to 0.7)[b] p=0.3	HRQoL Mental Health Component (SF-12-V2 MCS) 0.8 (-1.1 to 2.6)b p=0.3 . Patient Activation (PAM score): 1.9 (-0.1 to 3.8) p= 0.06. Chronic disease control: HBA1c -0.2 (-1.3 to 0.9), BMI -0.2 (-0.7 to 0.4), CPD -0.5 (-2.2 to 1.2), SBP -6.3 (-14.3 to 1.8). Patient reported quality of primary care: Intervention group were more likely to report highest rating for quality comprehensive care and supportiveness for self-management - risk difference 0.12 p=<0.001. HCU: Intervention group had fewer repeat admissions -0.24 (-0.40 to -0.07) p=0.02 and 30d readmissions -0.17 (-0.32 to -0.02) p=0.04, fewer total hospital days (300 vs 471) and statistically non significant fewer total hospitalisations -0.3 (-0.6 to 0.0) p=0.07 and shorter length of stay -3.1 (-6.3 to 0.2) p=0.06.
Kangovi et al, 2017	Change in chronic disease control: HBA1C −0.2 (−1.3 to 0.9) [c], BMI −0.2 (−0.7 to 0.4), CPD −0.5 (−2.2 to 1.2), SBP −6.3 (−14.3 to 1.8) p=0.08	Achievement of chronic disease management goals (% achieved) 18.3% vs 17.2% p=0.81 . HRQoL Physical Health Component (change in SF-12-V2 PCS): 0.9 vs 0.5 p=0.67 and HRQoL Mental Health Component (change in SF-12- V2 MCS) 2.3 vs -0.2 p= 0.008. Patient activation (change in PAM) 2.2 vs 1.5 p=0.66. Proportion of people reporting high quality of patient centred care that was comprehensive (49.2% vs 39.7% p=0.01) and supportive of disease management (62.9% vs 38% p=0.001). HCU: Intervention group had a total of 68 hospitalisations with 278 hospital days vs 98 hospitalisations and 414 hospital days in the control p=0.17.
Carnes et al	Not specified	Self rated health (scale 1 to5): 0.127 (−0.221 to 0.9475)[d] . Mental health, anxiety (HADS-A): −0.119 (−0.847 to 1.609). Mental health, depression (HADS-D): 0.857 (−0.737 to 2.451) Wellbeing (Scale of 0-6 in last week): −0.013 (−0.623 to 0.596) . Positive and active engagement in life (HeiQ Scale 0-20): −0.073 (−1.278 to 1.131). Number of regular activities (range 0-6): -0.897 (-1.729 to -0.065) p=0.035. HCU: A&E visits in the previous 3 months (mean (SD): Intervention 0.3 (0.68), Control 0.5 (1.15), but no baseline rate reported for the intervention group. Annual GP consultation rate before referral decreased in the intervention group and slightly increased in the control group, but there were significant baseline differences- Intervention 8.3 to 7.3, p=0.001, Control 2.9 to 3.3 p=0.014 and p=<0.001 for between group differences at baseline and follow up. The intervention group were prescribed

		significantly more medications at baseline and follow up than control p <0.001.
Dickens et al	Health Related Quality of Life, Mental Health Component (SF-12 MCS) 0.1 (-1.9, 2.1)[e]	HRQoL Physical Health Component (SF-12 PCS): 0.1 (-1.9 to 2.10) p=0.9. HRQoL (EQ-5D-3L): -0.09 (-0.14 to -0.03) p=<0.001. Depression (GDS): 0.2 (-0.2 to 0.7) p=0.29. Social Support (MOS-6): 0.03 (-0.2 to 0.2) p=0.75. Social Activities: No significant differences were reported between groups for number of friends/family, club/group membership or frequency of get together with friends/family. The intervention group were less likely to report getting along with others (OR 0.6 (0.4 to 0.9) p<0.01). Social Participation (General Household Survey items on housework, transport, childcare, advice, emotional support) was not different between groups.
Mercer et al	Health Related Quality of Life (EQ-5D-5L) 0.008 (–0.028 to 0.045)[f]	Well-being (ICECAP-A): –0.011 (–0.039 to 0.016) p=0.411. Mental health, anxiety (HADS-A): –0.41 (–0.99 to 0.18) p=0.172. Mental health, depression (HADS-D): 0.09 (–0.49 to 0.68) p=0.753. Work and social adjustment scale: 0.05 (-1.37 to 1.48) p=0.940. Self-reported lifestyle activities (smoking, alcohol, exercise): no difference between groups.

[a] Mean Difference (95% CI) adjusted for baseline results. [b] Longitudinal estimated difference in difference (95% CI) from 6 to 9 months adjusted for site and chronic disease. [c] Difference in difference (95% CI) controlled for baseline results and any imbalanced baseline variables [d] Mean difference (95% CI) adjusted for age, sex, ethnicity, employment status and living arrangement. [e] Mean difference (95% CI) adjusted for employment status, accommodation type and living circumstances. [f] Mean difference (95% CI) adjusted for age, sex, SIMD, comorbidity, and significant baseline outcome measures as covariates and includes practice identifier as a random effects term.

SF-12V2= Short Form Health Survey, is often used as a health related quality of life measure, with Physical (PCS) and Mental (MCS) health components reported separately on a scale of 0-100 with 100 representing maximal health. EQ-5D-5L=a standardized measure of self-reported health-related quality of life that assesses 5 dimensions at 5 levels of severity where 1 is the preferred state of health. EQ-5D-3L=an earlier version of EQ-5D-5L with 3 levels. GDS =Geriatric Depression Scale, a screening tool for depression in older people with a score of 4 or more indicating possible depression. HADS = Hospital Anxiety and Depression Scale measured on a scale of 0-42 where a higher score indicates worse mental health. HADS-A=Hospital Anxiety and Depression Scale, Anxiety, where a score above 10 indicates possible caseness; HADS-D=Hospital Anxiety and Depression Scale, Depression, where a score above 10 indicates possible caseness. Duke UNC Functional Social support scale measures an individual's social network, a higher score indicates stronger supports. MOS-6 Social support (six items from the Medical Outcomes Study Social Support Survey [MOS-SSS] where a higher score on scale of 1-6 indicates more support. ICECAPA= Investigating Choice Experiments for the Preferences of Older People Capability Measure for Adults, a capability based wellbeing measure for adults where 0 is no capability and 1 is full capability; WASAS = Work and Social Adjustment Scale that measures impact of mental health problems on daily life with higher scores denoting a greater impact.

BMI=body mass index, CPD= cigarettes per day, SBP=systolic blood pressure, HbA1C=glycosylated haemoglobin, decrease denotes improvement.

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 9
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 9
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 10
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 10
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 8
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 10
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 10
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 20
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 10
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 10
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 10
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 10

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 10
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 11
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 25
Study characteristics	17	Cite each included study and present its characteristics.	Page 15
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 17 and extended data
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3, Page 20 and see extended data
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 18, Summary of findings table
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Page 18
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Page 18 and see extended data GRADE assessment tables
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 23
	23b	Discuss any limitations of the evidence included in the review.	Page 25

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
	23c	Discuss any limitations of the review processes used.	Page 25
	23d	Discuss implications of the results for practice, policy, and future research.	Page 26
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 3
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 25
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	
Competing interests	26	Declare any competing interests of review authors.	
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
For more information, visit: http://www.prisma-statement.org/

BMJ Open

Effect of social prescribing link workers on health outcomes and costs for adults in primary care and community settings: a systematic review

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2022-062951.R1
Article Type:	Original research
Date Submitted by the Author:	03-Aug-2022
Complete List of Authors:	Kiely, Bridget; Royal College of Surgeons in Ireland, Department of General Practice Croke, Aisling; Royal College of Surgeons in Ireland, Department of General Practice O'Shea, Muireann; Royal College of Surgeons in Ireland, Department of General Practice Boland, Fiona; Royal College of Surgeons in Ireland, HRB Centre For Primary Care Research, Division of Population Health Sciences (PHS) O'Shea, Eamon; National University of Ireland Galway, School of Business and Economics Connolly, Deirdre; Trinity College, Occupational Therapy Smith, Susan; Trinity College Dublin, Discipline of Public Health and Primary Care; Royal College of Surgeons in Ireland, Department of General Practice
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Evidence based practice, Health services research
Keywords:	SOCIAL MEDICINE, PRIMARY CARE, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Effect of social prescribing link workers on health outcomes and costs for adults in primary care and community settings: a systematic review

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Word count: 6,200

ABSTRACT

Objectives: To establish the evidence base for the effects on health outcomes and costs of social prescribing link workers (non-health or social care professionals who connect people to community resources) for people in community settings focusing on people experiencing multimorbidity and social deprivation.

Design: Systematic review and narrative synthesis using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach.

Data sources: Cochrane database, Cochrane Central Register of Controlled Trials, ClinicalTrials.gov, EU Clinical Trials Register, CINAHL, Embase, Global Health, PubMed/MEDLINE, PsycInfo, LILACS, Web of Science, and grey literature were searched up to 31st July 2021. A forward citation search was completed on 9th June 2022.

Eligibility criteria: Controlled trials meeting the Cochrane Effectiveness of Practice and Organisation of Care (EPOC) guidance on eligible study designs assessing the effect of social prescribing link workers for adults in community settings on any outcomes. No language restrictions were applied.

Data extraction and synthesis: Two independent reviewers extracted data, evaluated study quality using the Cochrane EPOC risk of bias tool and judged certainty of the evidence. Results were synthesised narratively.

Results: Eight studies (n=6,500 participants), with five randomised controlled trials at low risk of bias and three controlled before-after studies at high risk of bias, were included. Four included participants experiencing multimorbidity and social deprivation. Four (n=2186) reported no impact on HRQoL. Four (n=1924) reported mental health outcomes with three reporting no impact. Two US studies found improved ratings of high-quality care and

reduced hospitalisations for people with multimorbidity experiencing deprivation. No cost effectiveness analyses were identified. The certainty of the evidence was low or very low.

Conclusion: There is an absence of evidence for social prescribing link workers. Policy makers should note this and support evaluation of current programmes before mainstreaming.

PROSPERO registration number: CRD42019134737.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This systematic review only included randomised trials and controlled before-after studies that met the Cochrane Effectiveness of Practice and Organisation of Care guidance, to avoid potentially biased results from poorer quality studies.
- Our literature search involved an in-depth search for social prescribing link worker interventions, using a wide range of search terms and with no language, country or date limitations.
- The area of social prescribing is a rapidly evolving field, and we conducted a forward citation search of included papers to capture any relevant studies published after our search.
- Our broad search resulted in a large number of studies and an initial screen of clearly ineligible studies was conducted by one author only, which may have introduced bias.
- The limited number of studies and heterogeneity in study design and intervention meant a meta-analysis was not possible and thus a robust narrative synthesis including an assessment of the certainty of the evidence was conducted.

INTRODUCTION

Social prescribing is a way of linking people with complex needs to non-medical supports in the community. There are different models of social prescribing, ranging from online signposting services to individual support from a link worker to access community resource. The link worker model of social prescribing is most frequently used in the UK.(1) Link workers are non-health or social care professionals, usually based in primary care or community organisations, who determine the health and well-being needs of people referred to them (usually by health care professionals), co-produce a health and well-being plan and provide support to connect with community resources to meet these needs. No qualifications are specified for link workers, rather there is a focus on relevant experience and skills, such as listening and empathising, to perform the role.(2) Many health systems are developing social prescribing initiatives and NHS England is funding link workers in primary care and recommends their use for people who have one or more chronic conditions, need support with their mental health, are isolated or who have complex social problems.(3)

People experiencing multimorbidity (defined as two or more chronic health conditions) experience fragmented care, poorer health outcomes and more psychological stress and as multimorbidity becomes the norm among an aging population, it poses a significant challenge to health systems.(4) People with complex multimorbidity account for a higher proportion of hospital admissions and therefore costs, and have higher consultation rates than those without.(5) In socially deprived areas, the impact is greater as people experience earlier onset of multimorbidity and are more likely to have mental health comorbidities.(6) A 2021 systematic review of interventions targeting people with multimorbidity in primary care identified 16 RCTs but found limited evidence for interventions that improve outcomes

including HRQoL and mental health outcomes.(7) The review did not identify any eligible social prescribing link worker interventions but concluded that existing evidence suggests that future research should target a range of areas including patient health behaviours that can be addressed though social prescribing.

Social prescribing link workers may have an impact on health outcomes for people experiencing multimorbidity, particularly in areas of social deprivation, but despite their widespread roll out in the U.K., there is limited evidence for their effectiveness.(8) If effective, social prescribing link workers should reduce health care costs, by addressing the social problems that reportedly drive 20% of primary care attendances and the social determinants of health that lead to poorer outcomes.(9) A recent systematic review, however, concluded that there was a lack of evidence for how, for whom and when social prescribing was effective or how much it cost.(10) Previous reviews have only looked at U.K. based interventions and included a broad range of studies including those with uncontrolled designs.(11, 12). Social prescribing is however gaining momentum internationally and while interventions are adapted to the local context, there are similarities and potential to learn from experiences in other countries. (13) We aimed to systematically review the evidence of effectiveness and costs of social prescribing link worker interventions internationally and to establish the evidence, if any, for their effectiveness in people with multimorbidity and social deprivation.

METHODS

We conducted a systematic review of studies reporting effectiveness and/or costs of social prescribing link workers based in primary or community care settings for community dwelling adults. We included randomised trials and non-randomised trials that met the Cochrane Effectiveness of Practice and Organisation of Care (EPOC) guidance on eligible

study designs.(14) We followed the PRISMA statement for reporting systematic reviews, (15) (Appendix 1, (16)), registered our review on Prospero CRD42019134737 (04/07/2019) and published the protocol. (17)

Eligibility criteria

Participants/population

We included studies on community dwelling adults attending primary care. Participants did not need to have any specific index condition. We included all studies whether they focused on participants in areas of social deprivation or not, but we specifically extracted data on social deprivation and multimorbidity where it was reported. We excluded studies on children and those in residential or supported care.

Intervention

Social prescribing link workers may be known by other terms such as community health workers, patient navigators or health facilitators. While all of these work in the area of health, they are generally considered "lay workers" as they have not completed formal professional health or social care qualifications. Similarly, the process of social prescribing may be known by other terms such as "community referral" or "navigation". Inclusion was based on the function of the role, i.e. supporting people to improve their health and wellbeing through connecting them with community resources and health and social care coordination, recognising that there is a wide range of terms used to describe such roles. (18)

We included interventions that involved:

- A referral (including self-referrals) to a link worker (a non-health or social care professional) who was based either in a primary care practice or a community or voluntary organisation.
- Participants meeting with a link worker face to face at least once, although additional contacts could be via telephone or other remote methods.
- Determining an individual range of health and social care supports and community resources that the person would be willing to engage with and being offered support and follow up to engage with their chosen supports and activities.

We excluded interventions without a link worker that only involved signposting to services, used volunteers as link workers or were delivered by telephone. Interventions where additional support was being provided by health care professionals or personal care provided alongside health and social care coordination such as disability support workers were excluded as it was not possible to separate the effects of the different components of care. We excluded multi-faceted interventions, which mainly comprised of education and goal setting around disease control or health behaviour change interventions, even if they had an element of social prescribing as it was not possible to separate the impact of the different components of the intervention.

Comparator(s)

We only included studies with a comparator group that did not involve any social prescribing and met the EPOC guidance on controlled before-after (CBA) studies, i.e. contemporaneous data collection, controls drawn from similar sites and at least 2 intervention and 2 control sites.(14)

Setting

Primary care was generally defined as "care provided by clinicians that are available to treat all common conditions in all age groups and have an ongoing relationship with their patients".(19) This definition allowed for a more flexible interpretation in countries that have different models of healthcare. We excluded studies that focused on hospital inpatients or specialist services or were emergency department based. The definition of social deprivation is debated. It varies from country to country and is usually based on relative socioeconomic capacity.(20) For this review, we did not have a definition of deprivation, rather we described how deprivation was defined in relevant studies.

Outcomes

Main outcome

We included all reported outcomes, but based on our interest in assessing link workers to support patient with multimorbidity, we focused on outcomes in the core outcome set for multimorbidity that recommends primary outcomes of quality of life, mental health and mortality for interventions focused on multimorbidity.(21)

The primary outcomes for the review were:

- Health related quality of life (HRQoL), as measured by a validated instrument.
- Mental health outcomes, as measured by a validated instrument for screening for mental health conditions.

Additional outcomes

Secondary outcomes included also focused on the core outcome set for multimorbidity.(21) While this is a wide range of outcomes it is in keeping with the MRC frameworks' guide on using multiple outcome measures for complex interventions.(22) These included:

- Patient-reported outcomes on social-connectedness or isolation, self-rated health, patient experience of care, treatment burden, self-management behaviour and self-efficacy.
- Physical activity and function included measures of physical activity (self-reported or objectively measured), physical function, activities of daily living.
- Health service utilisation defined as number of GP visits, ED attendances or hospital admissions as measured via primary care or hospital records or self-reported.
- Any physical health data reported was included.
- Any cost data or social return on investment data.

Search strategy

We searched 11 bibliographic and trials databases for randomised controlled trials and non-randomised controlled trials that meet the criteria outlined in the Cochrane Effective Practice and Organisation of Care (EPOC) guidance on study design(14) from inception up to July 2021 with no language limits: Cochrane database, Cochrane Central Register of Controlled Trials, ClinicalTrials.gov, EU Clinical Trials Register, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Embase, Global Health, PubMed/MEDLINE, PsycInfo, LILACS (Latin American and Caribbean Health Sciences Information database), and Web of Science. To identify economic evaluations that may be of relevance we also searched the NHS EED (NHS Economic Evaluation Database), Health Technology Assessment Database (both available via the Centre for Reviews and Dissemination (CRD), University of York) and CEA (Cost-Effectiveness Analysis Registry) up to July 2019. The search strategy

focused on the use of a range of key words associated with the intervention and was developed with input from a senior information specialist.

We conducted a grey literature search of the following databases: Irish Health Service Executive (HSE) Lenus, RIAN, Open Grey, DART EUROPE, Google and Google Scholar and WHOLIS (World Health Organization Library Information System) up to July 2021. We also conducted a forward and backward citation search of included studies. Relevant websites (The Kings Fund, NHS Social Prescribing, National Institute for Clinical Excellence, Social Prescribing Network, Health Foundation, Nuffield Trust, HSE Social Prescribing, and Oxford Social Prescribing Research Network) were searched manually for evaluations. The first 23 pages of a Google Search for "social prescribing" and the first 21 pages of a Google scholar search were reviewed for additional literature. Please see supplementary data, Appendix 2 for detailed search strategy. (16)

Data management

Rayyan was used to sort abstracts for inclusion and exclusion. References were managed with Endnote 8 reference manager. Excel was used to manage extracted data.

Review process

Duplicates were removed using the EndNote function, which identifies potential duplicates, which were then checked and manually reviewed by the lead author (BK). The lead author (BK) then did an initial screen to remove clearly ineligible titles. This step was necessary due to the large number of potentially eligible reports returned by our search strategy. Where it was clear from the title that our eligibility criteria on population, intervention or methods were not met the title was excluded. For example, a title clearly reporting a qualitative study of a healthcare intervention delivered by lay people to children, such as a qualitative study of

a community health worker intervention for childhood diarrhoea, would have been excluded. Any report where it was not clear from the title if eligibility criteria were met was reviewed by abstract by BK and AC, who independently reviewed the abstracts of all potentially eligible titles, discarded those that clearly did not meet inclusion criteria and independently reviewed the full texts of the remainder to assess eligibility for final inclusion. Any discrepancies were resolved through discussion with a third reviewer (SMS). Data extraction was completed by the lead author and checked by another author (MOS). Two authors (BK and AC) independently assessed and cross-checked the risk of bias in all included studies using the Cochrane EPOC Guidance for assessing risk of bias.(23) The certainty of the evidence for outcomes was independently assessed by two authors (BK and MOS) using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria including risk of bias, consistency of effect, imprecision, indirectness and other potential criteria such as publication bias.(24) Any discrepancies were discussed with the senior author (SMS) until consensus was reached. RCTs and CBAs were assessed separately. Overall certainty was based on assessment of evidence from RCTs where more than one was available.

Strategy for data synthesis

Due to the heterogeneity in terms of study design, risk of bias, participants, interventions and outcomes, a narrative synthesis was performed and presented in tabular form to include the following headings: study design, setting, participants, nature of intervention, outcome measures used, effects and costs. We explored the possibility of completing meta-analysis, however, in the two studies that were similar in terms of study design, intervention characteristics and duration of follow up, there was insufficient data reported on the primary outcomes. As there were only two studies, authors were not contacted for additional data. We

had planned to complete sub-group analyses based on multimorbidity, living in areas of social deprivation and link worker location, but this was not possible due to substantial methodological heterogeneity, including study design and definitions and reporting of multimorbidity and deprivation.

Public patient involvement

This review is part of one of four PhD projects under a Health Research Board collaborative doctoral award (CDA) in multimorbidity. The original CDA project application and PhD topics had input from a PPI advisory group. A multimorbidity PPI advisory group was set up specifically to support the four PhD projects in the CDA. The lead reviewer (BK) presented the results of this review to the group who provided input on implications for policy, practice and research, included in the discussion. See Appendix 3 Guidance on Reporting Involvement of Public and Patients (GRIPP) 2 form in supplementary data for further details on PPI methods. (16)

RESULTS

The database search identified 20,656 records after duplicate removal. 19,738 were removed after title screening leaving 918 abstracts for review. 553 full texts were assessed for eligibility including 216 identified from the database search and 397 from other sources. Seven reports of six studies were identified from the database search, one from backward citation searches and one from forward citation searches. Our forward citation search did not identify any corrections or errata related to the included studies. (See Figure 1: PRISMA Flow diagram)

Included studies and participants

Nine papers reporting eight studies, including 6,500 participants were identified. Five were randomised trials (RCTs),(25-29) three controlled before-after studies (CBAs)(30-32) and one paper reported the economic evaluation of an included trial.(33) Three studies were from the US (27-29) and five from the UK.(25, 26, 30-32)

Participants were majority female ranging from 59% to 75% with only one study reporting majority male participants (62%).(30) Mean age ranged from 29 to 71 years age. One study focused on adults over 75, but did not report mean age.(25) Three of the seven studies clearly reported including participants experiencing multimorbidity and deprivation. Two of the US trials tested an intervention, (the IMPaCT intervention) that targeted people with two or more chronic conditions, living in a high poverty zip code.(27, 28) One U.K. study was based in GP practices located in postcodes with high deprivation and reported a mean of 3.1 self-reported chronic conditions.(31) Otherwise, studies recruited participants based on a combination of factors including: social isolation,(25, 30, 32) mental health problems,(30, 32) age (25, 30), frequent ED attendance, (29) and GP perception of suitability for the intervention.(26, 31, 32)

Interventions and comparators

All interventions included referral to a link worker or equivalent, who identified a set of personalized goals and supported participants to achieve these through connecting with community resources. There was considerable variation in the duration and intensity of the link worker interventions. Intervention duration ranged from one month to two years, with most interventions ranging from three to nine months in duration. Intensity in terms of link worker caseload and number of contacts was only reported in detail in two of the seven

studies. The IMPaCT intervention evaluated in the two US trials was six months duration with weekly contacts as standard. Each link worker worked with 55 clients per year for an average of 38.4 hours suggesting an average of one hour per meeting.(34) No other studies reported on link worker caseload. Other interventions were less intense in terms of number of contacts. Carnes et al reported that 69% of participants met the link worker once and 17% had two or more contacts.(32) Grant et al reported a mean of 1.7 contacts and Mercer et al a mean of 3.1 contacts.(26, 31) The remaining two studies did not report on numbers of contacts.(25, 30) Resources referred to were tailored to the individual in all interventions with counselling services, social and craft groups, exercises classes, addiction supports, welfare and employment advice all mentioned as examples of resources. Only one study specifically reported on uptake of community resources with uptake of resources positively associated with number of link worker contacts and ranging from 36% of participants who had met once to 71% of participants who had met 4 times. (31)

All link workers had professional supervision arrangements, which varied across studies. They were managed and employed by either a research team or a host voluntary community organisation. While efforts were made to standardise the IMPaCT intervention,(34) with regular supervision and reviews, the other interventions were very flexible, and fidelity was not assessed. In some cases, there was considerable variation in how the intervention was implemented across sites, but this was part of a general tailored approach.(30, 31) The setting also varied. In three studies, link workers were embedded within general practice or equivalent.(28, 31, 32) In two of these studies one link worker was assigned to a practice. (28, 31) In the other, three link workers were based across 22 practices.(32) The link workers were based in community settings in the remaining five studies.

The comparator was usual care for all studies, with the inclusion of chronic disease goal setting as a co-intervention in two of the RCTs.(27, 28) The five RCTs randomised participants at the level of the individual. The three CBAs studies recruited controls from nearby GP practices with similar demographics but reported significant differences in demographics and baseline outcome scores between groups. See Table 1 for a summary.

Table 1. Summary of characteristics of included studies

Study ID	Participants	Intervention	Outcomes
Randomised trials			
Clarke et al, 1992 (25) Community, UK	523 adults over 75 living alone. Age, gender not reported	**Referral:** Recruited via mail invitation **Link worker:** Lay community-based health worker, training and experience not specified. **Contacts:** Minimum 3 home visits with tailored support **Duration:** 2 years **Comparator:** Usual care	**Primary outcome:** Survival **Secondary outcomes:** Activities of daily living Information/orientation score Loneliness Morale Self-rated health Social contacts Primary healthcare utilisation **Costs:** None reported **Data collection:** 0, 24 months. Survival assessed at 6 monthly intervals from baseline to 3.5 years
Grant et al, 2000 (26) Community, UK	152 adults over 16 who GP felt would benefit from intervention. Mean age 43.2, 75% female.	**Referral:** Recruited via GP referral **Link worker:** Lay "referral facilitator" trained and employed by a community organisation. Based in community. **Contacts:** 1 face-to-face assessment within a week of referral. Average of 1.7 telephone or face-to-face contacts reported. **Duration:** 1 month **Comparator:** Usual care	**Primary outcomes:** Mental health: depression and anxiety Social Support **Secondary outcomes:** Quality of life Functional health Primary healthcare utilisation including medications and referrals **Costs:** Intervention Primary healthcare utilisation Referrals to other agencies **Data collection:** 0, 1, 4 months
Heisler et al, 2022 (29) Community, USA	3,159 adults aged <65 residing in a low income zip code with >3 ED visits or 1 ambulatory care sensitive admission in last year. Mean age 29, 64% female.	**Referral:** Recruited via Medicaid **Link worker:** Community health workers, familiar with zip code, trained and employed by community organisations **Contacts:** 55% at least one contact, mean of 1.9 contacts **Duration:** Tailored, but up to 1 year **Comparator:** Usual care	**Primary outcomes:** Healthcare utilisations including • Ambulatory care visits • ED visits • Hospital admissions **Costs:** Healthcare utilisation costs **Data collection:** 12 months pre and post randomisation

Kangovi et al, 2018 (28) Primary Care, USA	592 adults attending 3 primary care clinics, who resided in a high-poverty zip code had a diagnosis for 2 or more chronic diseases. Mean age 52.6, 62.5% female.	**Referral:** Recruited via primary care clinics **Link worker:** Community health workers, with high school diploma. 1 month training in motivational interviewing, action planning and on the job. Based in primary care practices. **Contacts:** Monthly face-to-face meetings and weekly telephone check ins. **Duration:** 6 months **Comparator:** Chronic disease goal setting with PCP only	**Primary outcome:** Health related quality of life, physical health component (SF-12-V2 PCS) **Secondary outcomes:** Health related quality of life, mental health component (SF-12-V2 MCS) Patient activation Chronic disease control (BP, HbA1C, BMI or CPD) Patient-reported quality of primary care All cause hospitalisations **Costs:** None reported **Data collection:** 0, 6, 9 months
Kangovi et al, 2017 (27) Community, USA	302 adults attending GIM clinics, living in deprived area, and were diagnosed with 2 or more chronic diseases. Mean age 56, 74% female.	**Referral:** Recruited via primary care clinics **Link worker:** Community health workers, with high school diploma. 1 month training in motivational interviewing, action planning and on the job. Based in primary care practices. **Contacts:** Monthly face-to-face meetings and weekly telephone check ins. **Duration:** 6 months **Comparator:** Chronic disease goal setting with PCP only	**Primary outcome:** Change in chronic disease control (HbA1C, BMI, BP, or CPD) **Secondary outcomes:** Achievement of chronic disease management goals Health related quality of life (SF-12-V2 PCS and MCS) Patient activation Patient reported quality of primary care All cause hospitalisations **Costs:** Return on investment analysis reported on cost savings related to reduced hospitalisations **(33)** **Data collection:** 0, 6 months for PROMs. 6 and 12 months for hospitalisations
Controlled before-after studies			
Study ID	**Participants**	**Intervention**	**Outcomes**
Carnes et al, 2017 (32) Primary Care, UK	480 adults frequently attending primary care, who presented with social isolation or mild mental health problems. Median age 56, 59% female.	**Referral:** GP referral **Link worker:** 3 lay "social prescribing coordinators" (SPC) trained in social work and managed by community organisation. Based across 22 GP practices. Additional support from volunteers available. **Contacts:** Initial 1 hour meeting and up to 6 sessions with the SPC, unlimited volunteer support **Duration:** 6 months **Comparator:** Propensity matched controls drawn from GP practices in nearby areas with no social prescribing service.	**Primary outcome:** Not specified **Secondary outcomes:** Self-rated health Mental Health: depression and anxiety Wellbeing Positive and active engagement in life Number of regular activities A&E visits in past 3 months Annual GP consultation rate Number of medications in previous 6 months **Costs:** None reported **Data collection:** 0, 8 months

Dickens et al, 2011 (30) Community, UK	392 adults over 50 attending primary care at risk of social isolation. Mean age 71, 62% male.	**Referral:** GP referral **Link worker:** Mentors often with teaching or creative skills, managed by a community organisation. Training not described. Based in community. **Contacts:** Face to face meetings, frequency not specified **Duration:** 3 months **Comparator:** Matched controls from a sample drawn from 3 GP practices in nearby areas with no mentoring service	**Primary outcome:** Health related quality of life, mental health component (SF-12-V2 MCS) **Secondary outcomes:** Health related quality of life, physical health component (SF-12-V2 PCS) Health related quality of life (EQ-5D-3L) Mental health: depression Social activities Social support Social participation **Costs:** None reported **Data collection:** 0, 3 months
Mercer et al, 2019 (31) Primary Care, UK	900 adults attending primary care in most deprived areas of Glasgow deemed suitable for intervention by GP. Median age 49, 60% female.	**Referral:** GP referral **Link worker:** Community links practitioners with prior experience of community work, managed by a community organisation. 1 month training on role, supporting clients, engaging practices and mapping resources. Based in GP practices. **Contacts:** Face to face meetings. Average of 3 meetings reported. **Duration:** 9 months **Comparator:** Sample drawn from 6 GP practices in Glasgow without a community links practitioner	**Primary outcome:** Health related quality of life (EQ-5D-5L) **Secondary outcomes:** Wellbeing Mental Health: depression and anxiety Work and social adjustment scale Self-reported lifestyle behaviors (smoking, alcohol, exercise) **Costs:** None reported **Data collection:** 0, 9 months

Risk of bias

We used the EPOC guidance to assess risk of bias for both RCTs and CBAs, but have reported them separately for each study design. The RCTs had low risk of bias overall, despite blinding of participants not being possible given the nature of the intervention. Randomization processes were not clearly reported in one RCT.(25) There was high risk of bias in the CBAs. This was due to differences in baseline characteristics and limitations in randomization and allocation concealment due to study design. A summary of the risk of bias is shown in Figure 2. The full risk of bias assessment for all outcomes is available in Appendix 4 in supplementary data. (16)

Certainty of evidence

For the primary outcomes, the certainty across all study types was low for HRQoL and very low for mental health due to risk of bias, indirectness resulting from differences in interventions and populations across studies, inconsistencies in results and imprecision. The certainty was low for social supports, self-rated health and very low for physical function and activities. For health care utilization, there was very low certainty evidence for hospitalisations based on the US based RCTs.(27-29) There was low certainty evidence for primary care visits, due to indirectness, imprecision and risk of bias. See Table 2.

Table 1. GRADE summary of findings

Title: Effect of social prescribing link workers on health outcomes and costs for adults in primary care and community settings
Patients or population: Community dwelling adults
Settings: Primary and community care
Intervention: Social prescribing link workers
Comparison: Usual care

Outcome	Review finding	Contributing studies (participants)	Overall GRADE assessment
Health related quality of life	Social prescribing link workers may have little or no impact on HRQoL.	2 RCTs (894). US based 2 CBAs (1292) UK based	⨁⨁◯◯ Low (Low for RCTs [b, c, d]. Low for CBAs)
Mental health	It is unknown if social prescribing link workers improve mental health because the certainty of the evidence is very low.	1 RCT (152). 3 CBAs (1772) All UK based	⨁◯◯◯ Very Low [f] (Low for RCT [b,c] and Very Low for CBAs [a,b])
Social contacts and support	Social prescribing link workers may lead to little or no difference in social contacts.	2 RCTs (714). 1 CBA (392)	⨁⨁◯◯ Low (Low for RCTs [b,d],

		All UK based	Low for CBAs)
Physical function and activities	It is unknown if social prescribing link workers improve physical function and activity because the certainty of the evidence is very low.	2 RCTs (714) 2 CBAs (1380) All UK based	⊕⊖⊖⊖ Very low (Very Low RCTs [b,c,d] and Very Low CBAs [a,d])
Self-rated health	Social prescribing link workers may improve self-rated health.	2 RCTs (714) 1 CBA (480) All UK based	⊕⊕⊖⊖ Low (Low RCTs[b,c] and Low CBA[a])
Health care utilisation: hospitalisation	It is unknown if social prescribing link workers reduce hospitalisations because the certainty of the evidence is very low.	3 RCTs (4053) US based	⊕⊖⊖⊖[b,c,] Very Low
Health care utilisation: primary care visits	Social prescribing link workers may have little or no impact on primary care visits.	3 RCTs (3873) 2 UK and 1 US based 1 CBA (480) UK based	⊕⊕⊖⊖ Low (Low RCTs [b,d], Very Low for CBAs [a])

RCTs and CBAs were assessed separately for each outcome. If there was limited RCT evidence, then an overall judgement was applied. In this case if were inconsistencies in results between the two bodies of evidence this was downgraded by one level.

[a] Downgraded for risk of bias. [b] Downgraded for indirectness. [c] Downgraded for Inconsistency. [d] Downgraded for imprecision. [e] Downgraded for publication bias [f] Downgraded for overall inconsistency.

See Appendix 5 in supplementary data for the full GRADE summary sheet. (16)

Effectiveness of link worker interventions

Primary outcomes

Four of the eight studies (two RCTs and two CBAs) reported on HRQoL (27, 28, 30, 31) . Two studies used the EQ-5D measure with one study reporting no difference, (31) while the other study reported a small significant difference between the intervention and control

group, in favour of the control group. (30) Three studies used the SF-12 measure, with one of the three reporting a significant difference in favour of the intervention for the mental health component score, (27) whereas, none of the three studies reported any difference in physical component scores (27, 28, 30). Four studies reported on mental health (26, 30-32) using HADS-D, HADS-A or GDS-10. Only one of these studies reported evidence of a significant improvement in HADS-A, (aMD -1.9 (95% CI: -3.0 to -0.7).(26) The remaining three studies found no evidence of a difference between groups for any mental health outcomes. See Table 3 for a summary of the primary outcome effects.

Table 2. Primary outcomes: mean at follow up and adjusted mean differences

Health-related quality of life				
Study ID	**Outcome measure**	**Intervention Mean (SD)**	**Control Mean (SD)**	**Adjusted mean differences (95% CI)**
Kangovi et al, US 2018 RCT (28)	Physical Health Component (SF-12-V2 PCS)	1.8 (11.2)	1.6 (9.9)	−0.7 (−2.2 to 0.7) [a] P=0.3
	Mental Health Component (SF-12-V2 MCS)	2.2 (13.3)	1.2 (14.1)	0.8 (−1.1 to 2.6) [a] P=0.41
Kangovi et al, US 2017 RCT (27)	Physical Health Component (SF-12-V2 PCS)	0.9*	0.5*	P=0.66
	Mental Health Component (SF-12-V2 MCS)	2.3*	0.2*	P=0.008
Dickens et al UK 2011 CBA (30)	Physical Health Component (SF-12-V2 PCS)	34.8 (11.4)	42.7 (12.6)	0.8 (-1.5, 3.2) [b] P=0.48
	Mental Health Component (SF-12-V2 MCS)	46.7 (11.2)	49.2 (10.0)	0.1 (-1.9, 2.1) [b] P=0.9
	EQ-5D-3L	0.6 (0.3)	0.8 (0.2)	-0.09 (-0.14, -0.03) [b] P=<0.001

Mercer et al, UK 2019 CBA (31)	EQ-5D-5L	Not reported	Not reported	0.008 (–0.028 to 0.045) [c] P=0.648
Mental health				
Grant et al, UK 2000 RCT (26)	Depression (HADS-D)	7.1 (4.5)	9.4 (4.9)	−0.9 (−1.9 to 0.2) [d] P=0.116
Carnes et al, UK 2017 CBA (32)	Depression (HADS-D)	10.1 (5.0)	5.9 (5.2)	0.857 (−0.737, 2.451) [e] P=not reported
Dickens et al, UK 2015 CBA (30)	Depression (GDS-10)	4.1 (2.4)	2.2 (2.1)	0.2 (-0.2, 0.7) [b] P=0.29
Mercer et al, UK 2019 CBA (31)	Depression (HADS-D)	Not reported	Not reported	0.09 (–0.49 to 0.68) [c] P=0.753
Grant et al, UK 2000 RCT (26)	Anxiety (HADS-A)	10.6 (4.2)	12.7 (4.3)	−1.9 (−3.0 to −0.7)[a] P=0.002
Carnes et al, UK 2017 CBA(32)	Anxiety (HADS-A)	11.2 (5.0)	7.6 (5.4)	−0.119 (−0.847, 1.609) [e] P=not reported
Mercer et al, UK 2019 CBA (31)	Anxiety (HADS-A)	Not reported	Not reported	–0.41 (–0.99 to 0.18) [c] P=0.172
Clarke et al, UK 1992 RCT (25)	HRQoL or mental health were not outcomes for this trial			
Heisler et al, US 2022 RCT (29)	HRQoL or mental health were not outcomes for this trial			

SF-12v2= Short Form Health Survey, is often used as a health-related quality of life measure, with Physical (PCS) and Mental (MCS) health components reported separately on a scale of 0-100 with 100 representing maximal health. EQ-5D-5L=a standardized measure of self-reported health-related quality of life that assesses 5 dimensions at 5 levels of severity where 1 is the preferred state of health. EQ-5D-3L=an earlier version of EQ-5D-5L with 3 levels. GDS =Geriatric Depression Scale, a screening tool for depression in older people with a score of 4 or more indicating possible depression. HADS = Hospital Anxiety and Depression Scale measured on a scale of 0-42 where a higher score indicates worse mental health. HADS-A=Hospital Anxiety and Depression Scale, Anxiety, where a score above 10 indicates possible caseness; HADS-D=Hospital Anxiety and Depression Scale, Depression, where a score above 10 indicates possible caseness.

* Unadjusted mean difference - SD and adjusted mean differences not reported. [a] Longitudinal estimated difference in difference from 6 to 9 months adjusted for site and chronic disease. [b] Adjusted for employment status, accommodation type and living circumstances. [c] Adjusted for age, sex, SIMD, comorbidity, and significant baseline outcome measures as covariates and includes practice identifier as a random effects term. [d] Adjusted for baseline results. [e] Adjusted for age, sex, ethnicity, employment status and living arrangement.

Secondary outcomes

A wide range of other outcomes was reported, with the studies reporting a mean of six outcomes each, including a range of patient reported outcomes (PROMS). Three reported on a measure of social contact or support and found no evidence of a difference between groups (25, 26, 30). One study reported that intervention participants were more likely to rate getting along with others as "worse" than controls, indicating a possible negative effect (30). In terms of other PROMs, two studies found a positive impact on self-rated health (25, 26), one study found a positive effect for general quality of life, assessed by the Delighted Terrible Faces scale (26) and two studies reported a positive finding on patient rating of high quality care (27, 28). There were no reported differences for patient activation (27, 28), wellbeing (31, 32), loneliness (25), morale (25), work and social adjustment (31) or active participation in life (32). Of the four studies that reported a measure of physical activity and function, one study found an improvement in functional health (26), while two others found no evidence of a difference in ADLs (25), or physical activity (31) and the final study found a reduction in usual activities (32). Three studies reported clinical outcomes, one reported on survival over a three year period (25) and two looked at chronic disease control for smoking, diabetes, obesity and hypertension (27, 28). None reported a statistically significant difference between groups.

Six studies reported on health care utilization, with four reporting on primary care utilization (25, 26, 29, 32) and three on hospitalisations (27-29). One study reported a reduction in primary care attendances in the intervention group, but the control group were significantly different and the authors concluded that their findings more likely represented regression to the mean (32); of the remaining studies two found no evidence of an effect on primary health care attendances and one US based study actually found an increase in ambulatory care

utilisation.(29) One of the two US studies evaluating the IMPaCT intervention found a 24 % risk reduction in repeat hospital admissions during the 12 month follow up period (28); the other reported a similar reduction, but it did not reach statistical significance (27). The third study that reported hospital admissions found no significant decrease, but there was a decrease in ED attendances. (29) See Appendix 6 in supplementary data for a full list of outcomes and effects for each study.

Costs and cost effectiveness

No cost utility or cost effectiveness analyses were identified in our search. Three RCTs reported on costs (26, 29, 33); one as a cost analysis, one on health care utilisation costs only, and the third as a separately published return on investment analysis of an included RCT (27). The cost analysis looked at primary care visits, medications, referrals and interventions costs. While the study found a reduction in healthcare costs due to a reduction in referrals, these savings did not offset the costs of the intervention. Therefore, the authors concluded that the intervention was more costly than usual care. The analysis did not consider any measure of health benefits to participants such as quality of life years gained.(26) The trial that looked at health cate utilization did not report intervention costs. They found that the intervention group had slightly lower ED costs, higher ambulatory care costs and no difference in hospitalisation costs. (29) The return-on-investment study examined cost savings related to hospitalisations and outpatient attendances from routine data and included detailed costing of the intervention, which was calculated at $1721.06 per participant. While the number of reduced hospital days was statistically non-significant, they estimated a return of $2.47 for every $1 spent on the intervention.(33)

Subgroup synthesis: multimorbidity and social deprivation

Four of the eight studies reported a measure of multimorbidity or comorbidity. Two of these were RCTs of the IMPaCT intervention in the US and recruited participants with two or more chronic conditions including hypertension, diabetes, obesity and tobacco dependence.(27, 28) One was a CBA of the Glasgow Deep End link worker intervention and reported a mean of 3.1 chronic conditions in the intervention group, but this was not an inclusion criterion.(31) The final study was a US based RCT and reported that 27% of participants had a Charlson Comorbidity index of greater than two. All four studies targeted participants in areas of deprivation. Three of these studies measure HRQoL. Two of the studies found no effect and one of the US trials finding an effect on the Mental Health Component of the SF-12-V2 only,(27) which was not replicated in the second trial of this intervention. (28) Only the Deep End link worker CBA reported on mental health and found no evidence of a difference between groups. There were no reported significant effects on other patient reported outcome measures or chronic disease control. The RCTs of the IMPaCT intervention found a consistent improvement in the proportion of participants reporting high quality primary care. Both also examined hospitalisations, reporting fewer total days in hospital, although this only reached statistical significance in one of the two studies. The other US based trial that focused on frequent ED attenders in a deprived zip code found a reduction in ED attendances, but increased costs of ambulatory care and no difference in hospitalisations. (29)

DISCUSSION

We identified eight studies and one economic evaluation of an included study, but we found no consistent evidence to support the effectiveness of social prescribing link worker interventions for improving health related quality of life or mental health. There was no evidence for effectiveness in improving social support, physical function and activities, or

primary healthcare utilization, though there was a suggestion from two studies that interventions led to improved self-rated health and two others reported higher patient ratings for quality care. Three of the studies specifically included participants experiencing multimorbidity and social deprivation with similar findings for health-related quality of life, though two U.S. RCTs reported a reduction in total days in hospital for people with multimorbidity with low certainty evidence. The certainty of the evidence is low or very low overall due to risk of bias, heterogeneity amongst studies, inconsistency and imprecision.

Our systematic review has not identified any evidence on the cost effectiveness of social prescribing link workers. There is some evidence of cost savings based on reduced hospitalisations, but this was a US based study of an intense structured six-month intervention and may not translate to other healthcare systems.(33) Only one UK based study reported costs, showing a reduction in referral costs, but no cost benefit analysis or cost utility analysis was undertaken.(26) The economic evaluation of social prescribing link workers in the literature is weak.

There remains a lack of studies with a randomised design since the 2017 review (10) that called for “less rhetoric and more reality”. There have been many uncontrolled before-after studies identified in subsequent reviews, (11, 12, 35) but the last RCT in a UK setting was over 20 years ago. (26) Widening our search beyond the UK setting resulted in the identification of three relevant RCTs and a return-on-investment analysis in a US setting. (27, 28, 33). Ours is the first review to look specifically at populations experiencing multimorbidity or deprivation. We identified some evidence to support reduced hospital admissions for people experiencing multimorbidity and deprivation in the US. Two of these studies also found an improvement in patients rating of the quality of their primary care, which has been reported in previous multimorbidity studies. (36). The 2021 systematic review of multimorbidity highlighted the potential for interventions to improve patients

experience of care, (7) which some have argued should be an end in itself. (37). We reported on the intensity of the intervention, often omitted from previous reviews and indeed in many of the articles in this review. While intensity varied, a more intense intervention with a healthcare coordination component was the only one with a positive impact on healthcare utilisation.(33) These findings demonstrate that it is possible to conduct RCTs of social prescribing link worker interventions, but for those with complex needs more intense interventions delivered alongside chronic disease management programmes may be required to improve outcomes.

The main outcomes for the current review were HRQoL and mental health based on the core outcome set in multimorbidity (21), but only two of the seven studies reported on both of these (30, 31). With one exception (25) the rest reported on at least one. Most studies did cover some of the NHS draft outcome framework for social prescribing recommended outcomes: wellbeing, social connectedness, ability to manage day-to-day and physical activity. (3) However, as per previous reviews (10, 11, 38) there was a lot of variation in outcomes included and how they were measured, making it difficult to synthesise studies and further weakening the evidence. The outcomes chosen, in particular HRQoL may also have been difficult to improve in the short time frame of most studies. Improving social connections is one of the key mechanisms by which social prescribing is thought to improve outcomes, (39, 40), but only three studies reported on this. Including this as an outcome in future may help demonstrate interim impact, with the caveat that both relationships and causal mechanisms between social connection and health and well-being are still contested.

Strengths and limitations

This review involved a rigorous search of the international literature including all languages and the Grey Literature. We used a wide range of terms to describe the link worker role,

providing additional evidence on social prescribing link worker interventions. We had robust study design, inclusion criteria and only included studies that met the Cochrane EPOC guidance for inclusion in a systematic review.(23) Additional potentially eligible studies did not meet the inclusion criteria for this review due to non-contemporaneous comparisons, too few sites or offering some sort of social prescribing intervention to control groups.(41-43) Previous reviews have included uncontrolled studies with the argument that they are used by policy makers as evidence of effectiveness,(12) however, including these studies with weaker designs can lead to inflated effect sizes and distort the current evidence base. Unlike previous reviews, (10-12, 35, 44) we appraised the overall certainty of the evidence for our selected outcomes, which was low or very low for most outcomes. This review provides the most up to date review of evidence internationally for social prescribing link worker interventions.

Due to the complex nature of social prescribing link worker interventions, there may have been a degree of subjectivity in determining which ones to include. To minimize this all full texts were independently reviewed and where there was a question over intervention inclusion, it was discussed with a third author. Our protocol made it clear that it was important that social prescribing was the main element of the intervention, but interpretation of this is also dependent on reporting in potentially eligible studies (17). The field is rapidly expanding, and we may have missed studies published since July 2021. Our forward citation search carried out in June 2022 will go some way to mitigate this. We are also aware of protocols that have not published results or were suspended due to COVID-19, including an RCT that we have conducted with analysis ongoing.(45)

Implications for policy and practice

It could be argued that only four of the studies tested interventions that reflect the format of current social prescribing link worker activities in the UK, which are relatively short and

tailored to the individual and locality, with a high degree of flexibility (26, 30-32). Even among these, there is variation in terms of the intensity of support and link worker location, with both community and primary care settings. Embedding link workers in a general practice setting can facilitate more intense support and a focus on healthcare coordination, such as in the US IMPaCT intervention.(34) One of the UK studies reported that a sub-group of participants who met a link worker three or more times had improvements in HRQoL, mental health and exercise, suggesting intervention duration and intensity is important to consider.(31) Current plans for social prescribing link workers in Ireland and the UK suggest at least double the link worker caseload of the IMPaCT intervention, (46, 47) and a shorter intervention, that may limit link worker capacity to provide the level of support required to provide benefit, particularly for people with multimorbidity living in deprived areas. There is a need to consider flexibility in how new link worker social prescribing interventions are implemented until more evidence is available on how much and what type of support is required and whether such support needs to be better targeted given ever tighter budget constraints and existing health inequalities.

Policy makers need to be aware that there is insufficient evidence to assess the effectiveness of social prescribing link workers and none on the cost effectiveness so the opportunity cost is unknown. While it is anticipated that social prescribing link workers will reduce healthcare utilization at the primary care level (9), many evaluations of social prescribing link worker services struggle to get access to healthcare utilisation data.(48) Robust evaluations with both patient reported outcome data and access to healthcare utilisation data to assist economic evaluations need to be embedded into social prescribing programmes. Evidence from this review suggests that such evaluations are possible and that more intense interventions for certain high-need subgroups are worth developing and evaluating in local health care contexts.

The PPI group felt a flexible approach was necessary as some people may need longer support, but also raised the issue of fairness for those who have less complex needs who could benefit from shorter interventions. They agreed with the author team's conclusions that social prescribing link workers should not be rolled out more widely without evaluations built in and also felt that outcomes and the way they were measured would benefit from patient input.

Implications for future research

For future research and evaluations to address the evidence gap a number of challenges need to be overcome. Social prescribing interventions are meant to be flexible and tailored, not just to the individual, but also the context. This however results in a lot of heterogeneity and difficulty in assessing an overall body of evidence. Future studies could address this by reporting on reasons for referral, duration of intervention, number of contacts and link worker caseload. Further research is also needed to better understand the components of social prescribing and indeed is underway.(49) Since the pandemic link workers have adapted to restrictions and use more remote supports, which has impacted participants experiences. (50) The impact of this on outcomes is yet to be evaluated.

There are no agreed outcomes or measures for social prescribing. The NHS does not recommend any specific measures in its draft outcomes framework that recommends self-management, physical activity and social connectedness as individual outcomes. (3). The Health Service Executive in Ireland also recommends assessing wellbeing and social connectedness, but not mental health or HRQoL (48). Without the inclusion of a measure that can be used for cost utility analysis, building the evidence base around cost effectiveness will be challenging. The EuroQoL HRQoL measure, EQ-5D-5L (51), is one such measure, but it can be difficult to show changes in a relatively short timeframe (52) and is quite health

focused whereas social prescribing has potentially wider social benefits. The ICECAP-A (The ICEpop CAPability measure for Adults) is an alternative. (53) It measures capability well-being, can be used in economic evaluations and is recommended by NICE for use in evaluations of interventions with potential health and social benefits. (54) Future studies should consider its inclusion as an outcome. As mentioned previously social connectedness is another important interim measure to consider. The Medical Research Council Framework for the Evaluation of Complex Intervention to Improve Health Outcomes recommends multiple outcome measures. In the case of social prescribing a more refined outcomes framework with specified measures developed with input from service users, providers and academics is needed.

The widespread policy of rolling out social prescribing projects regardless of the lack of certainty around cost effectiveness makes it challenging for researchers to address the evidence gap, especially in identifying suitable controls. While some CBAs in this review attempted to match controls, there were often significant differences in baseline characteristics as controls were drawn from different populations. (30, 32) Where social prescribing has already been adopted by policy makers stepped wedge cluster RCTs and interrupted time series offer an alternative approach to CBAs and can control better for confounding. (55) Other jurisdictions considering implementing social prescribing should carefully consider how they evaluate it from inception. RCTs are feasible as shown by the trials in the review. They are of course challenging given the tailored nature of social prescribing link worker interventions, and parallel process evaluations are recommended to evaluate contextual factors and mechanisms of action, (56), which in turn can inform further refining of existing programmes. It is clear, however, that further uncontrolled before-after studies will not advance the evidence base.

CONCLUSIONS

Our systematic review suggests that link workers providing social prescribing may have little or no impact on HRQoL, mental health or a range of patient reported outcomes though may improve self-rated health. For patients with multimorbidity in areas of deprivation an intensive link worker intervention probably improves patients' ratings of high-quality primary care and reduces hospitalisations, but these findings are based on two studies in the US and require evaluation in other health systems. The opportunity costs of investing in social prescribing link workers are unknown and it is essential that high quality trials determining cost effectiveness are conducted so that the evidence can catch up with the policy and we avoid wasting valuable time and resources.

CONTRIBUTORS

BK was the primary reviewer and designed and conducted the search, reviewed identified texts, extracted data, performed the narrative synthesis and wrote the main draft. AC was a second reviewer of identified texts and for the quality assessment. MOS performed citation searches, verified data extraction and was second reviewer for certainty of evidence assessment. FB provided statistical support, wrote the protocol for meta-analysis and advised on feasibility of same. EOS provided health economics expertise and advised on

identification and summary of cost analysis studies. DC provided input into the search protocol, in particular descriptions and definitions of the link worker role. SMS conceptualised the original review questions, was involved in designing methods of the review and acted as a third reviewer. All authors contributed to critique and revisions of draft manuscripts and have approved the final version.

COMPETING INTERESTS

The authors declare that they have no competing interests.

ACKNOWLEDGMENTS

Paul J Murphy MLIS (Information Specialist, Royal College of Surgeons Ireland Library, 26 York Street, D02 YN77) advised on search strategies.

ETHICS STATEMENT

This study did not involve human or animal subjects and did not require ethical approval.

FUNDING

This research was funded by the Health Research Board Ireland (Grant reference HRB CDA 2018 Reference CDA-2018-003). The funders did not have any role in the design of this study.

DATA AVAILABILITY STATEMENT

Supplementary data are available on the Open Science Framework: Kiely, B. (2022, July 19). Effect of social prescribing link workers on health outcomes and costs for adults in primary care and community settings: a systematic review. https://doi.org/10.17605/OSF.IO/G2Y4C

This project contains the following supplementary data:

- Appendix 1: PRISMA checklist for "A systematic review of the effectiveness of link workers providing social prescribing on health outcomes and costs for adults in primary care and community settings."
- Appendix 2: Full Search Strategy and Results
- Appendix 3: GRIPP 2 Form for PPI
- Appendix 4: Risk of Bias tables
- Appendix 5: GRADE Assessment Sheets
- Appendix 6: All outcomes table

REFERENCES

1. Polley MJ, Fleming, J., Anfilogoff, T. and Carpenter, A. Making sense of Social Prescribing. London: Univeristy of Westminiter; 2017 18/08/2017.
2. NHS. NHS Careers: Social Prescribing Link worker NHS Careers: NHS;

2021 [Available from: https://www.healthcareers.nhs.uk/explore-roles/wider-healthcare-team/roles-wider-healthcare-team/clinical-support-staff/social-prescribing-link-worker/social-prescribing-link-worker.
3. NHS. Social Prescribing England: NHS; 2020 [Available from: https://www.england.nhs.uk/personalisedcare/social-prescribing/.
4. Wallace E, Salisbury C, Guthrie B, Lewis C, Fahey T, Smith SM. Managing patients with multimorbidity in primary care. BMJ. 2015;350.
5. Payne RA, Abel GA, Guthrie B, Mercer SW. The effect of physical multimorbidity, mental health conditions and socioeconomic deprivation on unplanned admissions to hospital: a retrospective cohort study. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2013;185(5):E221-8.
6. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet. 2012;380(9836):37-43.
7. Smith SM, Wallace E, Clyne B, Boland F, Fortin M. Interventions for improving outcomes in patients with multimorbidity in primary care and community setting: a systematic review. Systematic Reviews. 2021;10(1):271.
8. Husk K, Elston J, Gradinger F, Callaghan L, Asthana S. Social prescribing: where is the evidence? The British journal of general practice : the journal of the Royal College of General Practitioners. 2019;69(678):6-7.
9. Drinkwater C, Wildman J, Moffatt S. Social prescribing. BMJ. 2019;364:l1285.
10. Bickerdike L, Booth A, Wilson PM, Farley K, Wright K. Social prescribing: less rhetoric and more reality. A systematic review of the evidence. BMJ Open. 2017;7(4).
11. Pescheny JV, Randhawa G, Pappas Y. The impact of social prescribing services on service users: a systematic review of the evidence. Eur J Public Health. 2020;30(4):664-73.
12. Vidovic D, Reinhardt GY, Hammerton C. Can Social Prescribing Foster Individual and Community Well-Being? A Systematic Review of the Evidence. International journal of environmental research and public health. 2021;18(10):5276.
13. Morse DF, Sandhu S, Mulligan K, Tierney S, Polley M, Chiva Giurca B, et al. Global developments in social prescribing. BMJ Global Health. 2022;7(5):e008524.
14. Cochrane. Cochrane Effective Practice and Organisation of Care (EPOC): Cochrane; 2017 [Available from: https://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/Resources-for-authors2017/what_study_designs_should_be_included_in_an_epoc_review.pdf.
15. Moher D, Liberatia A, Tetzlaff J, Altman D. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 2009;6(7).
[dataset] 16. Kiely B, Croke A, O'Shea M, Boland F, O'Shea E, Connolly D, et al. Effect of social prescribing link workers on health outcomes and costs for adults in primary care and community settings: a systematic review Open Science Framework2022 [updated 19.07.22. Available from: https://doi.org/10.17605/OSF.IO/G2Y4C.
17. Kiely B CA, O'Shea E et al. . Effectiveness of link workers providing social prescribing on health outcomes and costs for adult patients in primary care and community settings. A protocol for a systematic review of the literature. [version 2; peer review: 2 approved]. . HRB Open Res 2020;2(21).
18. Tierney S, Wong G, Mahtani KR. Current understanding and implementation of 'care navigation' across England: a cross-sectional study of NHS clinical commissioning groups. British Journal of General Practice. 2019;69(687):e675.

19. Smith S. Interventions for improving outcomes in patients with multimorbidity in primary care and community settings - Smith, SM - 2016 | Cochrane Library. Cochrane Library of Systematic Reviews. 2016.
20. Butler DC, Petterson S, Phillips RL, Bazemore AW. Measures of social deprivation that predict health care access and need within a rational area of primary care service delivery. Health services research. 2013;48(2 Pt 1):539-59.
21. Smith SM, Wallace E, Salisbury C, Sasseville M, Bayliss E, Fortin M. A Core Outcome Set for Multimorbidity Research (COSmm). Ann Fam Med. 2018;16(2):132-8.
22. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ. 2008;337.
23. Cochrane. Cochrane Effective Practice and Organisation of Care (EPOC) Resources for review authors 2017 [Available from: epoc.cochrane.org/resources/epoc-resources-review-authors.
24. GRADE. Grade Working Group 2019 [Available from: http://www.gradeworkinggroup.org/.
25. Clarke M, Clarke SJ, Jagger C. Social Intervention and the Elderly:A Randomized Controlled Trial. American Journal of Epidemiology. 1992;136(12):1517-23.
26. Grant C, Goodenough T, Harvey I, Hine C. A randomised controlled trial and economic evaluation of a referrals facilitator between primary care and the voluntary sector. BMJ. 2000;320.
27. Kangovi S, Mitra N, Gr, e D, Huo HR, Smith RA, et al. Community Health Worker Support for Disadvantaged Patients With Multiple Chronic Diseases: A Randomized Clinical Trial. American Journal of Public Health.107(10):1660-7.
28. Kangovi S, Mitra N, Norton L, Harte R, Zhao X, Carter T, et al. Effect of Community Health Worker Support on Clinical Outcomes of Low-Income Patients Across Primary Care Facilities: a Randomized Clinical Trial. JAMA internal medicine. 2018;178(12):1635-43.
29. Heisler M, Lapidos A, Kieffer E, Henderson J, Guzman R, Cunmulaj J, et al. Impact on Health Care Utilization and Costs of a Medicaid Community Health Worker Program in Detroit, 2018–2020: A Randomized Program Evaluation. American Journal of Public Health. 2022;112(5):766-75.
30. Dickens AP, Richards SH, Hawton A, Taylor RS, Greaves CJ, Green C, et al. An evaluation of the effectiveness of a community mentoring service for socially isolated older people: a controlled trial. BMC public health. 2011;11:218-.
31. Mercer SW, Fitzpatrick B, Grant L, Chng NR, McConnachie A, Bakhshi A, et al. Effectiveness of Community-Links Practitioners in Areas of High Socioeconomic Deprivation. Ann Fam Med. 2019;17(6):518-25.
32. Carnes D, Sohanpal R, Frostick C, Hull S, Mathur R, Netuveli G, et al. The impact of a social prescribing service on patients in primary care: a mixed methods evaluation. BMC Health Services Research. 2017;17:1-9.
33. Kangovi S, Mitra N, Grande D, Long JA, Asch DA. Evidence-Based Community Health Worker Program Addresses Unmet Social Needs And Generates Positive Return On Investment. Health Affairs. 2020;39(2):207-13.
34. Kangovi S, Carter T, Charles D, Smith RA, Glanz K, Long JA, et al. Toward A Scalable, Patient-Centered Community Health Worker Model: Adapting the IMPaCT Intervention for Use in the Outpatient Setting. Popul Health Manag. 2016;19(6):380-8.
35. Reinhardt GY, Vidovic D, Hammerton C. Understanding loneliness: a systematic review of the impact of social prescribing initiatives on loneliness. Perspectives in Public Health. 2021;141(4):204-13.
36. Salisbury C, Man MS, Bower P, Guthrie B, Chaplin K, Gaunt DM, et al. Management of multimorbidity using a patient-centred care model: a pragmatic cluster-randomised trial of the 3D approach. Lancet. 2018;392(10141):41-50.
37. Dowrick C. Patient-centred care for multimorbidity: an end in itself? Lancet. 2018;392(10141):4-5.
38. Thomas G, Lynch M, Spencer LH. A Systematic Review to Examine the Evidence in Developing Social Prescribing Interventions That Apply a Co-Productive, Co-Designed Approach to

Improve Well-Being Outcomes in a Community Setting. International journal of environmental research and public health. 2021;18(8):3896.
39. Tierney S, Wong G, Roberts N, Boylan A-M, Park S, Abrams R, et al. Supporting social prescribing in primary care by linking people to local assets: a realist review. BMC medicine. 2020;18(1):49.
40. Kellezi B, Wakefield JRH, Stevenson C, McNamara N, Mair E, Bowe M, et al. The social cure of social prescribing: a mixed-methods study on the benefits of social connectedness on quality and effectiveness of care provision. Bmj Open. 2019;9(11).
41. Maughan DL, Patel A, Parveen T, Braithwaite I, Cook J, Lillywhite R, et al. Primary-care-based social prescribing for mental health: an analysis of financial and environmental sustainability. Prim Health Care Res Dev. 2016;17(2):114-21.
42. Foster A, Thompson J, Holding E, Ariss S, Mukuria C, Jacques R, et al. Impact of social prescribing to address loneliness: A mixed methods evaluation of a national social prescribing programme. Health & Social Care in the Community. 2021;29(5):1439-49.
43. Embick ER, Maeng DD, Juskiewicz I, Cerulli C, Crean HF, Wittink M, et al. Demonstrated health care cost savings for women: findings from a community health worker intervention designed to address depression and unmet social needs. Archives of women's mental health. 2020.
44. Costa A, Sousa C, Seabra PRC, Virgolino A, Santos O, Lopes J, et al. Effectiveness of Social Prescribing Programs in the Primary Health-Care Context: A Systematic Literature Review. . Sustainability 2021;13(2731).
45. Kiely B, Clyne B, Boland F, Donnell P, Connolly D, Shea E, et al. Link workers providing social prescribing and health and social care coordination for people with multimorbidity in socially deprived areas (the LinkMM trial): protocol for a pragmatic randomised controlled trial. BMJ Open. 2021;11(2):e041809.
46. NHS. NHS Long Term Plan: NHS; 2019 [Available from: https://www.longtermplan.nhs.uk.
47. HSE. HSE Social Prescribing Framework 2021 [Available from: https://www.hse.ie/eng/about/who/healthwellbeing/our-priority-programmes/mental-health-and-wellbeing/hse-social-prescribing-framework.pdf.
48. HSE. Building the capacity for the evaluation of social prescribing. Evaluability assessment. : HSE; 2020 [Available from: https://www.hse.ie/eng/about/who/healthwellbeing/our-priority-programmes/mental-health-and-wellbeing/building-capacity-for-the-evaluation-of-social-prescribing-evaluability-assessment.pdf.
49. Tierney S, Mahtani KR. Understanding the implementation of link workers in primary care: A realist evaluation to inform current and future policy: NIHR; 2021 [Available from: https://fundingawards.nihr.ac.uk/award/NIHR130247.
50. Morris SL, Gibson K, Wildman JM, Griffith B, Moffatt S, Pollard TM. Social prescribing during the COVID-19 pandemic: a qualitative study of service providers' and clients' experiences. BMC Health Services Research. 2022;22(1):258.
51. Gusi N, Olivares PR, Rajendram R. The EQ-5D Health-Related Quality of Life Questionnaire. In: Preedy VR, Watson RR, editors. Handbook of Disease Burdens and Quality of Life Measures. New York, NY: Springer New York; 2010. p. 87-99.
52. Fortin M, Stewart M, Ngangue P, Almirall J, Bélanger M, Brown JB, et al. Scaling Up Patient-Centered Interdisciplinary Care for Multimorbidity: A Pragmatic Mixed-Methods Randomized Controlled Trial. Ann Fam Med. 2021;19(2):126-34.
53. Al-Janabi H, N Flynn T, Coast J. Development of a self-report measure of capability wellbeing for adults: the ICECAP-A. Quality of Life Research. 2012;21(1):167-76.
54. NICE. Developing NICE Guidelines: the manual London: National Institute for Health and Care Excellence; 2014 [updated 15/10/2020. Available from: https://www.nice.org.uk/process/pmg20/chapter/incorporating-economic-evaluation.
55. Schünemann HJ, Cuello C, Akl EA, Mustafa RA, Meerpohl JJ, Thayer K, et al. GRADE guidelines: 18. How ROBINS-I and other tools to assess risk of bias in nonrandomized studies should

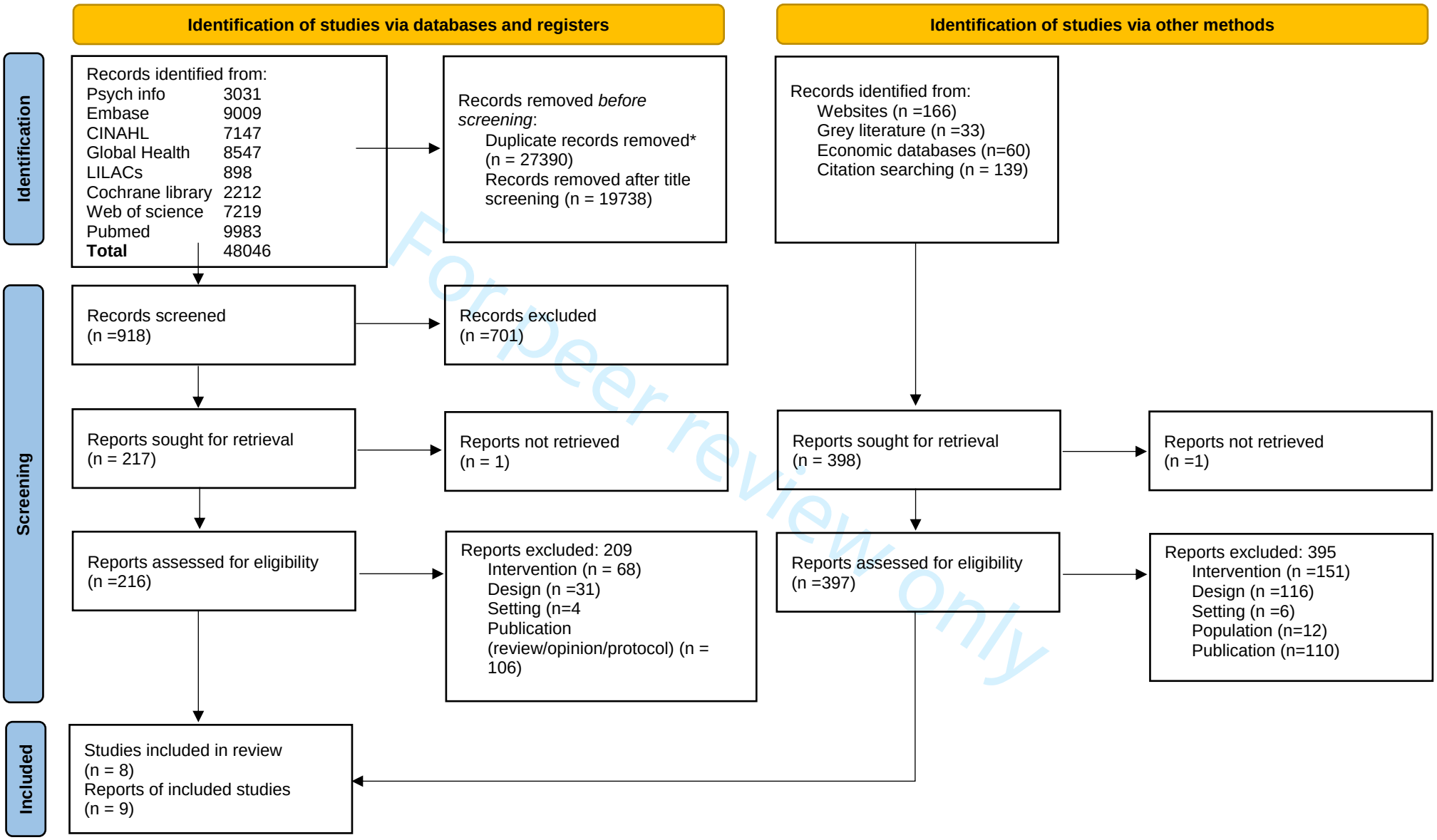
be used to rate the certainty of a body of evidence. Journal of clinical epidemiology. 2019;111:105-14.
56. Moore GF, Audrey S, Barker M, Bond L, Bonell C, Hardeman W, et al. Process evaluation of complex interventions: Medical Research Council guidance. BMJ : British Medical Journal. 2015;350:h1258.

FIGURE TITLES

Figure 1. PRISMA flow diagram

Figure 2. Risk of bias summary

Figure 1 PRISMA flow diagram



*Duplicates were removed using EndNote Find Duplicate function

Figure 2. Risk of Bias Summary

Random sequence generation
Allocation concealment
Baseline outcome measurements similar
Baseline characteristics similar
Incomplete outcome data
Knowledge of the allocated interventions adequately prevented
Protection against contamination
Selective outcome reporting
Other risks of bias

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 6
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 10 and Appendix 2
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix 2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 11
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 12
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect	Page 9
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 10
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 12
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 23
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 12
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 12
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 12
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 12
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 12
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 13
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 29
Study characteristics	17	Cite each included study and present its characteristics.	Page 17
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 20 and Appendix 4
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3, Page 23 and see Appendix 6
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 21, GRADE Summary of findings table and Appendix 5
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Page 21
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Page 21 and see Appendix 5 GRADE assessment tables
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 28
	23b	Discuss any limitations of the evidence included in the review.	Page 28

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
	23c	Discuss any limitations of the review processes used.	Page 29
	23d	Discuss implications of the results for practice, policy, and future research.	Page 30
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 3
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 7
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 34
Competing interests	26	Declare any competing interests of review authors.	Page 34
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 34

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Effect of social prescribing link workers on health outcomes and costs for adults in primary care and community settings. A systematic review.

	PubMed 21/07/2021	Items
1	“wellbeing program*”	59
2	“community health advisor*”	95
3	“community health worker*”	8536
4	“community facilitator*”	48
5	“community navigator*”	17
6	“community referral*”	186
7	“lay health worker*”	421
8	“link-worker*”	85
9	“link worker*”	85
10	“linkworker*”	26
11	“patient navigator*”	584
12	“social prescri*”	240
13	1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12	9983

	EMBASE on Embase.com 21/07/2021	Items
1	'wellbeing program*'	234
2	'community health advisor*'	11
3	'community health worker*’	6272
4	'community facilitator*’	65
5	'community navigator*’	44
6	'community referral*’	324
7	'lay health worker*'	554
8	'link-worker*'	105
9	'link worker*'	105
10	'linkworker*’	23
11	'patient navigator*'	1225
12	'social prescri*’	284
13	1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12	9009

	CINAHL on Ebscohost 22/07/2021	Items
1	social N1 prescri* OR patient N1 navigator* OR linkworker* OR link N1 worker* OR lay N1 health N1 worker* OR community N1 referral* OR community N1 navigator* OR community N1 facilitator* OR community N1 health N1 worker* OR community N1 health N1 advisor* OR wellbeing N1 program*	7147

	PSYCHINFO on Ebscohost 22/07/2021	Items
1	social N1 prescri* OR patient N1 navigator* OR linkworker* OR link N1 worker* OR lay N1 health N1 worker* OR community N1 referral* OR community N1 navigator* OR community N1 facilitator* OR community N1 health N1 worker* OR community N1 health N1 advisor* OR wellbeing N1 program*	3031

	WEB OF SCIENCE, Science & Social Science Citation Indexes on Clarivate 22/07/2021	Items
1	TS=(social NEAR/1 prescri* OR patient NEAR/1 navigator* OR linkworker* link NEAR/1 worker* OR lay NEAR/1 health NEAR/1 worker* OR community NEAR/1 referral* OR community NEAR/1 navigator* OR community NEAR/1 facilitator* OR community NEAR/1 health NEAR/1 worker* OR community NEAR/1 health NEAR/1 advisor* OR wellbeing NEAR/1 program*)	7548
2	Limit 1 to articles, meeting, conference abstracts	7219

	COCHRANE LIBRARY and Central Registry of Clinical Trials 22/07/2021	Items
1	wellbeing NEAR/1 program*:ti,ab,kw	65
2	(community NEAR/1 health NEAR/1 advisor* OR community NEAR/1 health NEAR/1 worker*):ti,ab,kw	1691
3	(community NEAR/1 facilitator*OR community NEAR/1 navigator* OR community NEAR/1 referral):ti,ab,kw	21
4	(lay NEAR/1 health NEAR/1 worker* OR link NEAR/1 worker* OR linkworker*):ti,ab,kw	206
5	patient NEAR/1 navigator*:ti,ab,kw	286
6	social NEAR/1 prescri*:ti,ab,kw	20
7	1 OR 2 OR 3 OR 4 OR 5 OR 6	2212
	The Central Registry of Clinical Trials result now includes trials data from Clinical Trials.gov [230] and WHO International Clinical Trials Registry Platform ICTRP [26]	

	Global Health on OVID 22/07/2021	
1	(wellbeing program OR wellbeing programs OR community health advisor OR community health advisors OR community health worker OR community health workers OR community facilitator OR community facilitators OR community navigator OR community navigators OR community referral OR lay health worker OR lay health workers OR link worker OR link workers OR linkworker OR linkworkers OR patient navigator OR patient navigators OR social prescribing OR social prescription).ti,ab.	8547
	EU Clinical Trials Register https://www.clinicaltrialsregister.eu/ctr-search/search 22/07/2021	Items
1	“wellbeing program” OR “wellbeing programs” OR "community health advisor" OR "community health advisors" OR "community health worker" OR "community health workers" OR "community facilitator" OR "community facilitators" OR "community navigator" OR "community navigators" OR “community referral” OR "lay health worker" OR "lay health workers" OR "link worker" OR "link workers" OR linkworker OR linkworkers OR "patient navigator" OR "patient navigators" OR "social prescribing" OR "social prescription"	0

	LILACS http://lilacs.bvsalud.org/en/ 22/07/2021	
	wellbeing program* OR community health advisor OR community health advisor* OR community health worker* OR community facilitator* OR community navigator*OR lay health worker* OR link worker* OR linkworker*	0

	OR patient navigator* OR social prescribing	

Summary of records retrieved from other sources

Grey literature search for Effect of link workers providing social prescribing on health outcomes and costs for adults in primary care and community settings: a systematic review".
Completed September 2021, updated July 2022

1. **Search of Websites**

Relevant websites were searched manually for a social prescribing section or publications section. If a search engine was available for these sections the search term "social prescribing" and "link worker" were used. Publications listed were reviewed by title/summary for relevant evaluations. Websites were searched sequentially so reports identified previously were not retrieved from subsequent website searches. Websites were searched in September 2021, expect for the Kings fund library and Social Prescribing Network resources, which were updated in June 2022.

2. **Grey literature search Engines** were searched using terms "link worker" and "social prescribing".

3. **Google**

Google Search term "Social prescribing"

Returned 29, 800, 000

23 pages results reviewed until results repeated or irrelevant

21 web pages visited.

9 evaluations of social prescribing retrieved. All were unpublished evaluations conducted for Clinical Commissioning Groups with no controls.

1 full report was not retrieved, despite email contact with the relevant CCG.

Rest were descriptive pages of services

4. **Google Scholar**

Search term "Social prescribing"

774, 000 results, up to page 37, 21 new potentially relevant reports retrieved. 0 titles added. 3 protocols, 12 design, 3 reviews, 2 wrong intervention, 1 population.

5. **Economic Search**

CEA registry (https://cear.tuftsmedicalcenter.org/) and York Centre for Reviews and Dissemination (https://www.crd.york.ac.uk/CRDWeb/ResultsPage.asp) search engines were searched with key words "wellbeing program OR wellbeing programs OR community health advisor OR community health advisors OR community health worker OR community health workers OR community facilitator OR community facilitators OR community navigator OR community navigators OR community referral OR lay health worker OR lay health workers OR link worker OR link workers OR linkworker OR linkworkers OR patient navigator OR patient navigators OR social prescribing OR social prescription".

Table 1: Details of Grey literature search including reasons retrieved reports were excluded

			Reasons not included						
Websites	**Results returned**	**Records reviewed**	**Design**	**Intervention**	**Publication**	**Population**	**Already included**	**Not retrieved**	**Setting**
Kings Fund	77	77	17	11	48		1		
Social Prescribing Network	69	69	19	14	32	3			1
HSE Social Prescribing	3	1	1						
ESRI	2	0							
NHS	0								
Social Prescribing Academy	0								
Health Foundation	3	3	2	1					
Nuffield Trust	1	1	1						
Oxford Social Prescribing Network	5	5	3	1	1				
NICE	136	11	8		3				
Total=	**296**	**167**	**51**	**27**	**84**	**3**	**1**		**1**
Grey literature search engines									
HSE Lenus	44	0							
Rian	2	2	1		1				
DART Europe	2	0							
Open Grey	2	1	1						
WHOLIS	0								
Google	N/A	9	8					1	
Google Scholar	N/A	21	12	2	6	1			
Total=	**50**	**33**	**22**	**2**	**7**	**1**	**0**	**1**	**0**
Economic Search Engines									
CEA Register	33	33		30		3			
CRD York	27	27		17	6	4			
Total=	**60**	**60**		**47**	**6**	**7**			

Citation Searches

1. Systematic reviews identified in the search were reviewed to identify any additional evaluations referenced or included in the review.
2. Backward citation search was conducted by reviewing references of included articles.
3. Forward citation search was conducted using Web of Science and updated in June 2022.
4. Citation searches were conducted independently by BK and MOS and any discrepancies agreed through discussion.

Table 2: Details of Citation Searches included number records reviewed from each source and reasons excluded.

Citation searches	**Systematic Reviews**	**Backward**	**Forward**	**Total**
Intervention	43	5	27	75
Setting	2		3	5
Design	17	5	21	43
Publication	3		9	12
Population	0	1	1	2
Other			1	1
Total	65	11	62	138

Table 2 Public Patient Involvement reported according to Guidance for Reporting Involvement of Patients and the Public (GRIPP) 2 Short Form

1: Aim
The aim of the PPI was to provide the perspective of people living with multimorbidity on the implications of the results of a systematic review on the effectiveness of social prescribing link workers.
2: Methods
An advisory panel of six people living with multimorbidity was recruited via existing networks of students on a PhD program in multimorbidity. The panel meets quarterly to provide input on issues brought to them by the PhD students. The members are voluntary but receive a voucher to acknowledge their time and associated costs attending. The panel had been meeting for three years prior to providing input on this study. The meeting at which this study was discussed took place online, lasted two hours in total including a break and was facilitated by BK and 2 other PhD students on the multimorbidity PhD program. There was one hour dedicated to discuss the systematic review with them. The group received a 500 word plain language summary of the findings of the systematic review one week in advance of the meeting. BK also summarised the methods and findings in a powerpoint presention during the meeting. The group divided into small groups and discussed the implications for practice, policy and future research and fed back to a plenary discussion afterwards.
3: Study results
The group were surprised about the limited evidence and wondered if the outcomes had been appropriate or asked in the right way. They agreed that quality of life was a good overall outcome and felt hospitalisations would matter from the taxpayer perspective. Determining a set of outcomes was felt to be beyond the time available and we agreed it would involve a separate piece of research work. As individuals they did not feel that social prescribing needed to be presented as an experimental intervention, as many interventions or medications may not work for an individual and they felt their healthcare provider would recommend what they thought might work for them, but acknowledged this wasn't guaranteed in the case of social prescribing. They felt policy makers should roll social prescribing out on a pilot basis over a number of years and evaluate it along the way. In terms of targeting specific groups the PPI group felt that social prescribing should be available to whoever might need it, but that it would have to be flexible to allow longer support for those with more complex needs.

Table 2 Public Patient Involvement reported according to Guidance for Reporting Involvement of Patients and the Public (GRIPP) 2 Short Form

4: Discussion and conclusions
The group clearly came to the meeting with a positive perception of social prescribing and felt it was a great idea that should be tested. Despite this possible lack of objectivity, the group broadly agreed with the conclusions that the research team had made. Their input highlighted the need for a set of core outcomes for social prescribing with input from potential beneficiaries. They took a more flexible approach on recommendations around specific target groups and intervention intensity, preferring an individually tailored intervention rather than limit access to those with the highest need.
5: Reflections/critical perspective
While the lack of cost effectiveness evidence was highlighted the idea of opportunity cost was not discussed. Presenting an intervention with no cost evidence base against one with cost evidence base however would be an impossible comparison. It is hard in a group format to check understanding of what has been presented, but given that conclusions were aligned with those of the research team it is reasonable to assume the group understood what was presented and asked of them.

Study ID	HRQOL Allocation concealment	Baseline outcome measurements similar	Baseline characteristics similar	Incomplete outcome data	Knowledge of the allocated interventions adequately prevented during the study	Protection against contamination	Selective outcome reporting	Other risks of bias	Overall Judgement per study	Overall judgement for outcome
Kangovi et al, 2018, RCT, SF-12	Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: there were slighly more participants of hispanic ethnicity in one arm-0 vs 3.7%	Low risk: 79% ad 81% f/up in int and control and multiple imputation techniques used for missing data	Unclear risk: not possible to blind to intervention and outcome was patient reported, although RAs collecting data were blinded	Unclear risk: randomisation was at the patient level, however unlikely controls received the intervention, but not explicitedly stated whether intervention was avaialble outside the trial setting	Low risk: all outcomes are reporoted	Unclear:The authors offer commerical consulting services on setting up similar CHW interventions since 2018 after this publication	Low risk: low risk of bias in 6/9 areas, and other areas unlikely to have significant impact on ROB. While the paper is at risk of overly presenting positive fidnings all outcomes are reported along with statistical significance.	
Kangovi et al, 2017, RCT, SF-12	Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: Intervention group were more likely to be empolyed 20% vs 8%	Low risk: 88% and 87% complete data, multiple imputation	Unclear risk: not possible to blind to intervention and outcome was patient reported,	Unclear risk: randomisation was at the patient level, however unlikely they received	Low risk: all outcomes are reported	Unclear-The authors offer commerical consulting services on setting up	Low risk: low risk of bias in 6/9 areas, and other areas unlikely to have	Summary Judgement RCTs: Low risk of bias

					although RAs collecting data were blinded	controls received the intervention, so not a major factor for overall ROB		similar CHW interventions	significant impact on ROB. While the paper is at risk of overly presenting positive fidnings all outcomes are reported along with statistical significance.
Dickens et al, 2011, CBA, SF-12	High risk: CBA and evidence of selection bias with those from more deprived backgrounds not being offered entry	Low risk: significant differences in baseline scores, although linear regression model used which would have corrected for baseline scores	High risk: differences in basleine characteristics although these were adjusted for in analysis	Low risk: low rates of missing data, 84% follow up intervention and 93% control and did separate paired and unpaired analysis	Unclear risk- unclear how follow up assessments were done, by whom and if blinded	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Devon, no competing interests declared.	High risk: high risk or unclear risk in 4 of 9 areas
Dickens et al, 2011, CBA, EQ-5D-3L	High risk: CBA and evidence of selection bias with those from more deprived backgrounds not being offered entry	Low risk: significant differences in baseline scores, although linear regression model used which would	High risk: differences in basleine characteristics although these were adjusted for in analysis	Low risk: low rates of missing data, 84% follow up intervention and 96% control	Unclear risk- unclear how follow up assessments were done, by whom and if blinded	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Devon, no competing interests declared.	High risk: high risk or unclear risk in 4 of 9 areas

		have corrected for baseline scores								
Mercer et al, 2019, CBA, EQ-5D-5L	Unclear risk: practices randomly assigned but how not stated	Low risk: significant differences in baseline- explicitly corrected for in analysis	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: 76% follow up int, 92% control, ITT analysis	High risk: due to the nature of the intervention not possible to assess outcomes blindly	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Scotland, no competing interests declared.	Unclear or High risk of bias in 4 of 9 areas	Summary Judgement NRCTS: High risk of Bias due to non randomised design and challenge of finding suitable controls.

Mental Health

Study ID	Allocation concealment	Baseline outcome measurements similar	Baseline characteristics similar	Incomplete outcome data	Knowledge of the allocated interventions adequately prevented during the study	Protection against contamination	Selective outcome reporting	Other risks of bias	Overall Judgement per study	Overall judgement for outcome
Grant et al, 2000, RCT, HADS A and HADS D	Low risk: sealed opaque envelopes, while there was an early error- this was identifed and those	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no	Low risk: similar amounts of missing data in both arms, at 67%, however this reduced power to detect a	High risk: due to the nature of the intervention not possible to blind participants and self reported outcome	Unclear risk: randomisation was at the patient level within practices, unclear if the intervention was availale outside the	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health autothirty, no competing interests declared.	Low risk: low risk in 7 of 9 areas, blinding very challenging given nature of intervention and were using	Summary Judgement RCTs: low risk of bias

	participants excluded		impact on reuslts when adjusted for in analysis	difference as required sample size was 161		trial-suggestion it was already running, so people may have received it before entering the trial			validated PROMs
Carnes et al, 2017, CBA, HADS A and HADS D	High risk: CBA	Low risk: significant differences in baseline scores, althouhg linear regression model used which would have corrected for baseline scores	High risk: significant differences in living arrnagement, education, work status, adjustments for same did not significantly alter results, suggesting other unknown imbalances	High risk: control follow up 43%, int 35%, no data on whether those LTFup had different baseline characteristics	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by DoH, independent research group, no competing interests declared.	High risk: high risk in 5 of 9 areas
Dickens et al, 2011, CBA, GDS	High risk: CBA and evidence of selection bias with those from more deprived background	Low risk: significant differences in baseline scores, although linear regression model used	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: low rates of missing data, 84% follow up intervention and 96% control	Unclear risk: due to the nature of the intervention not possible to blind participants and unclear	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Hackney CCG, no competing	High risk: high risk or unclear risk in 4 of 9 areas

	s not being offered entry	which would have corrected for baseline scores			how follow up collected			interests declared.	
Mercer et al, 2019, CBA, HADS A and HADS D	Unclear risk: practices randomly assigned but how not stated	Low risk: significant differences in baseline-explicitly corrected for in analysis	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: 76% follow up int, 92% control	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported, statisticians were blinded	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Scotland, no competing interests declared.	High or unclear risk of bias in 4 of 9 areas
Summary Judgement nRCTS: high risk of bias due to difficulty in concealing allocation, baseline differences in control groups, non randomisied design									

Social Contacts

Clarke et al, RCT	Unclear risk- register of all >75s living alone compiled and arranged into deciles by social contact	Unclear risk- Method of randomisation not sepcified	Low risk- reported and no signficant differences in baseline outcomes	High risk- characteristics such as age, gender, education etc not reported, only baseline outcome	Low risk- similar loss to follow up in both arms, with reasons	Unclear risk- participants would be aware of their allocation, although interview assesors	Low risk- while randomised at patient level it seems very unlikely control group would	Low risk- all outcomes reporte din baseline were reported at follow up	Low risk- pulicly funded, no competing interests declared	Low risk- while some areas unclear due to lack of reporting, unlikely to affect outcome, low risk in

	score and randomly allocated into control and experimental arms- how randomised not specified			measures referred to as characteristics		were blinded	have recived intervention as it was not available other than through the trial			5 of 9 areas	
Grant et al 2000, RCT, Dukes UNC score	Low risk: Sequenced numbered envelopes prepared by research team, block randomisation	Low risk: sealed opaque envelopes, howevere reported that there were isssues in ealr y stages and some patients excluded	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no impact on reuslts when adjusted for in analysis	Low risk: similar amounts of missing data in both arms, at 67%, however this reduced power to detect a difference as required sample size was 161	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Unclear risk: randomisation was at the patient level within practices, unclear if the intervention was running in the local area so possible patients could have accessed it outside the trial	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health autothirty, no competing interests declared.	Low risk: low risk in 7 of 9 areas	Low risk: Both RCTs mainly low risk- risks arise from poor reporting and nature of intervention
Dickens et al, 2011, CBA, MOS-6	High risk: controlled before after study	High risk: CBA and evidence of selection	Low risk: significant differences in baseline scores,	High risk: differences in basleine characteristics	Low risk: low rates of missing data, 84% follow up	Unclear risk: due to the nature of the interventio	Low risk: the service was not available in areas	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by	High risk: high or unclear risk in 4 of 9 areas	High risk: only one CBA and it is at high risk of bias

		bias with those from more deprived backgrounds not being offered entry	although linear regression model used which would have corrected for baseline scores	although these were adjusted for in analysis	intervention and 96% control	n cannot blind participants and not stated how outcomes were assessed	where the control lived	NHS Scotland, no competing interests declared.	
Overall: Low risk: Evidence from two RCTs									

Physical Activity

Clarke et al, RCT, ADLs	Unclear risk- register of all >75s living alone compiled and arranged into deciles by social contact score and randomly allocated into control and experimental arms- how randomised not specified	Unclear risk- Method of randomisation not sepcified	Low risk- reported and no signficant differences in baseline outcomes	High risk- characterisitics such as age, education etc not reported, only baseline outcome measures referred to as characteristics	Low risk- similar loss to follow up in both arms, with reasons	Unclear risk- participants would be aware of their allocation, although interview assesors were blinded	Low risk- while randomised at patient level it seems very unlikely control group would have recived intervention as it was not available other than through the trial	Low risk- all outcomes reporte din baseline were reported at follow up	Low risk- pulicly funded, no competing interests declared	Low risk- while some areas unclear due to lack of reporting, unlikely to affect outcome, low risk in 5 of 9 areas

Grant et al 2000, RCT, COOP Wonca Daily Activities	Low risk: Sequenced numbered envelopes prepared by research team, block randomisation	Low risk: sealed opaque envelopes	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no impact on reuslts when adjusted for in analysis	Low risk: similar amounts of missing data in both arms, at 67%, however this reduced power to detect a difference as required sample size was 161	Unclear risk: due to the nature of the intervention not possible to blind participants but assessors blinded	Unclear risk: randomisation was at the patient level within practices, unclear if it participants could self refer to the project which was running in the local area	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health autothirty, no competing interests declared.	Low risk: low risk in 7 of 9 areas	Overall RCTs:Low risk, most evidence comes from RCTs at low risk of bias
Carnes et al, 2017, CBA, Number regular activities	High risk: controlled before after study	High risk: CBA	low risk: significant differences in baseline scores, althouhg linear regression model used which would have corrected for baseline scores	High risk: significant differences in living arrangement, education, work status, adjustments for same did not significantly alter results, suggesting other unknown imbalances	High risk: control follow up 43%, int 35%, no data on whether those LTFup had different baseline characteristics	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by DoH, independent research group, no competing interests declared.	High risk: high risk in 5 of 9 areas	

Mercer et al, 2019, CBA, Physical activity	High risk: controlled before after study	Unclear risk: practices randomly assigned but how not stated	Low risk: significant differences in baseline- explicitly corrected for in analysis	High risk: differences in baseline characteristics although these were adjusted for in analysis	Low risk: 76% follow up int, 92% control	High risk: due to the nature of the intervention not possible to assess outcomes blindly and patients self reported	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by NHS Hackney CCG, no competing interests declared.	High risk: High or unclear risk in 4 of 9 areas	Overall nRCTs: High Risk: One study at very high risk of bias and one at high risk of bias
Overall: High risk due to inclusion of CBAs, without these low risk, although some concerns about allocation concealment that is inherent to the intervention											

Health Care Utilisation

Clarke et al, RCT, Primary care visits	Unclear risk- register of all >75s living alone compiled and arranged into deciles by cosial contact score and randomly allocated into control and experiment	Unclear risk- Method of randomisation not sepcified	Low risk- reported and no signficant differences in baseline outcomes	High risk- characterisitics such as age, education etc not reported, only baseline outcome measures referred to as characteristics	Low risk- similar loss to follow up in both arms, with reasons	Low risk- participants would be aware of their allocation, although interview assesors were blinded. HCU was self reported to assessors	Low risk- while randomised at patient level it seems very unlikely control group would have recived intervention as it was not available other than	Low risk- all outcomes reporte din baseline were reported at follow up	Low risk- pulicly funded, no competing interests declared	Low risk- while some areas unclear due to lack of reporting, unlikely to affect outcome, low risk in 5 of 9 areas	

	al arms- how randomised not specified					through the trial				
Grant et al 2000, RCT, PC visits, referrals, medications	Low risk: Sequenced numbered envelopes prepared by research team, block randomisation	Low risk: sealed opaque envelopes	Low risk: no important differences and baseline scores were adjusted for in analysis	low risk: control were slighlty more likely to be male and younger but otherwise comparable, this had no impact on results when adjusted for in analysis	Low risk: similar amounts of missing data in both arms, data on HCU available for 157	Unclear risk: not reported if outcome assessors were blinded or how health care utilisation data was obtained	Unclear risk: randomisation was at the patient level within practices. GPs were more interested in social interventions	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by Avon health authority, no competing interests declared.	Low risk: low risk in 7 of 9 areas
Kangovi et al, 2018, RCT, All cause hospital admissions 9 months	Low risk: computerised generated algorithm with blocks, performed by study team member not assocaited with	Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: there were slightly more participants of hispanic ethnicity in one arm-0 vs 3.7%	Low risk: 100% data available for health care utilisation	Low risk- Hospitalisation data from routine sources and assessors/statisticians were blinded.	Low risk: randomisation was at the patient level, however unlikely they received controls received the intervention, so not a	Low risk: all outcomes are reporoted	The authors offer commerical consulting services on setting up similar CHW interventions	Low risk: low risk of bias in 7/9 areas, and other areas unlikely to have significant impact on ROB. While the paper is at risk of overly presenting

	outcomes assessment						major factor for overall ROB			positive fidnings all outcomes are reported along with statistical significance.	
Kangovi et al, 2017, RCT, SF-12, all cause hospitalisations 1 year	Low risk: conputerised generated algorithm with blocks, performed by study team member not assocaited with outcomes assessment	Low risk: centralised randomisation scheme	Low risk: Baseline outcome measures were similar	Low risk: Intervention group were more likely to be empolyed 20% vs 8%	Low risk: 100% data available for health care utilisation	Low risk- Hospitalisation data from routine sources and assessors/statisticians were blinded.	High risk: randomisation was at the patient level, however unlikely they received controls received the intervention, so not a major factor for overall ROB	Low risk: all outcomes are reporoted	The authors offer commerical consulting services on setting up similar CHW interventions	Low risk- low risk 7/9 areas and other domains such as allocation inherent to nature of intervention or contamination due to patient level randomisation	Overall RCTs: Low risk of bias
Carnes et al, 2017, CBA, PC visits	High risk: controlled before after study	High risk: CBA	High risk: significant differences in baseline scores, and controls were drawn from same practice population, but not	High risk: significant differences in living arrnagement, education, work status, adjustments for same did not	Low risk: use of anonymised GP data meant no missing data	Low risk- anonymised data frm GP records	Low risk: the service was not available in areas where the control lived	Low risk: all outcomes were reported	Low risk: No other risks identified. Funded by DoH, independent research group, no competing interests declared.	High risk: high risk in 4 of 9 areas	Overall nRCTs: High risk of bias due to control mismatch in particular

			deemed suitable for referral (different to controls for other outcomes)	significantly alter results, suggesting other unknown imbalances						
"Heisler et al, US 2022 RCT "	Low risk	Low risk	Low risk	low risk	Low risk- use of routine data	Low risk- HCU data from routine sources and statisticians blinded	Low risk- patient level randomisation	Low risk: all outcomes were reported	Low risk. No COI, variety of funding sources, but no input into conduct of study	Low risk
Overall: Low risk of bias for RCTs, only 1 CBA at high risk										

Summary of findings:

Social prescribing link workers compared to usual care for people with multimorbidity

Patient or population: people with multimorbidity

Setting: Primary Care

Intervention: social prescribing link workers

Comparison: usual care

Outcomes	Impact	№ of participants (studies)	Certainty of the evidence (GRADE)
Health related quality of life (RCTs) assessed with: SF-12 HRQoL measure follow-up: range 6 months to 9 months	Two RCTs reported no difference in the physical health component of the SF-12. One of these trials showed a postive impact on the mental health component of the SF-12 (2.3 vs -0.2 p= 0.008.), but the other showed no difference.	894 (2 RCTs)	⨁⨁◯◯ Low[a,b]
Health related quality of life (CBAs) assessed with: EQ-5D and SF-12 HRQoL measures follow-up: range 3 months to 9 months	One CBA reported no difference in the MCS or PCS of the SF-12. The same trial reported a small change in the EQ-5D-3L in favour of the control group (-0.09 (-0.14 to -0.03) p=<0.001). The second CBA found no difference in the EQ-5D-5L.	1292 (2 observational studies)	⨁◯◯◯ Very low[c]
Mental Health (RCTs) assessed with: Mental Health as assessed by the hospital anxiety depression scale follow-up: mean 4 months	One RCT found an improvement in the anxiety component of the HADS (-1.9 (-3.0 to -0.7)a p=0.002) , but not the depression component (-0.9 (-1.9 to 0.2) p=0.116)	152 (1 RCT)	⨁⨁◯◯ Low[d,e]
Mental Health (CBAs) assessed with: Mental health as assessed by a screening tool for mental illness follow-up: range 3 months to 9 months	One CBA reported no difference in the geriatric depression scale. Two CBAs found no difference in the HADS anxiety or depression scales.	1772 (3 observational studies)	⨁◯◯◯ Very low[f,g]
Social support and contacts (RCTs) follow-up: range 4 months to 24 months	One RCT of a two year intervention for people aged over 75 found no difference in Tunstalls social cotact score. One RCT of a one month intervention found no difference in Dukes Social Support Scale.	714 (2 RCTs)	⨁⨁◯◯ Low[h,i]
Social contacts and supports (CBAs) follow-up: mean 8 months	One CBA looked at social support as measured by the Medical outcomes survey: social support scale and found no difference.	392 (1 observational study)	⨁◯◯◯ Very low[j]
Self rated health (RCTs) follow-up: range 4 months to 24 months	Two RCTs examined self rated health. One using a simple scale reported a greater % improved in the intervention (20%) than control group (11%). The other used the WONCA-COOP functional health scale that includes a measure of overall health and found an improvement favouring the intervention group (-0.4 (-0.7 to -0.1) p=0.003).	734 (2 RCTs)	⨁⨁◯◯ Low[k,l]

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Outcomes	Impact	№ of participants (studies)	Certainty of the evidence (GRADE)
Self rated health (CBAs) assessed with: Likert scale from 1 (poorest health) to 5 (best health) follow-up: mean 8 months	One CBA examined self rated health and found no difference between groups. (0.127 (−0.221, 0.9475) p=not reported)	480 (1 observational study)	⊕◯◯◯ Very low[m]
Physical Activities (RCTs) assessed with: Any measurement of daily activities or exercise follow-up: range 4 months to 24 months	One RCT of 152 adults found an improvement in daily activities (Daily Activities -0.5 (-0.6 to -0.2) p=0.001) but no effect on physical fitness (-0.3 (-0.6 to 0.05) p=0.98). The other of a 2 year intervention in adults over 75 found no difference in activities of daily living.	712 (2 RCTs)	⊕◯◯◯ Very low[n,o,p]
Physical activities (CBAs) assessed with: Any measure of daily activities or exercise follow-up: mean 8.5 months	One CBA found no difference in self reported exercise. The other found a decrease in daily activities in the intervention group (-0.897 (-1.729 to -0.065) p=0.035).	1380 (2 observational studies)	⊕◯◯◯ Very low[q,r,s]
Hospitalisations (RCTs) assessed with: Number of hospital admissions and number of days hospitalised follow-up: range 9 months to 12 months	Two RCTs reported a decrease in hospitalisations in the intervention group. One found a reduction in days in hospital (300 days vs 471 days; absolute event rate reduction,65%) at nine months. The other reported a reducton in hospitalisations and hospital days in the intervention group-68 total hospitalizations (278 hospital days) versus 98 (414 hospital days) in the control group. Neither reached statistical significance. A third RCT found no difference between groups for hospitalisations (adjusted IRR 0.97 (0.77, 1.24). All trials were US based.	4053 (3 RCTs)	⊕⊕◯◯ Low[t,u]
Primary Care Utilisation (RCTs) follow-up: range 4 months to 24 months	Two UK RCTs found no difference between groups for contacts with the primary care team and one US RCT found an increase in ambulatory care costsfor the intervention group but not attendances.	3873 (3 RCTs)	⊕⊕◯◯ Low[v,w]
Primary Care Utilisation (CBAs) follow-up: mean 8 months	The authors reported a reduction in the number of primary care visits in the intervention group and an increase in the control group, but because of baseline imbalances in the groups it was difficult to attribute this change to the intervention.	480 (1 observational study)	⊕◯◯◯ Very low[x,y]

Summary of findings:

Social prescribing link workers compared to usual care for people with multimorbidity

Patient or population: people with multimorbidity

Setting: Primary Care

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Comparison: usual care

Outcomes	Impact	№ of participants (studies)	Certainty of the evidence (GRADE)

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. The two RCTs examined a similar intervention but found different results for the MCS of the SF-12

b. The two RCTs were conducted in a single health care setting and may not transfer to other healthcare settings

c. One RCT looked at a deprived population over nine months, the other looked at an older, less deprived population over three months

d. The population was less deprived than in other studies and the usual target populations for link worker interventions and the intervention was only one month long

e. The confidence interval for anxiety included a change that was clinically insignificant.

f. Risk of bias was high in one CBA due to missing data, baseline differences and in all due to blinding

g. One CBA looked at an older less deprived population over three months, while the other two included a more deprived younger population over eight to nine months

h. One study looked at a two year intervention in over 75s which would not be typical of link worker interventions. The other study looked at a less deprived population than usually targeted for link worker interventions

i. One study did not provide confidence intervals and the other had a small sample size.

j. The CBA looked at a less deprived population than usually targeted for link worker interventions.

k. One study looked at participants aged over 75 with an intervention duration of 2 years, whereas the other was in a younger, less deprived population and intervention was 4 months.

l. Studies used different measures, one being a subscale of the WONCA/COOP Functional Health questionnaire. One RCT had a small sample size of 152.

m. There were baseline differences between the intervention and control groups. There was a significant loss to follow up of almost 70%.

n. Studies used slightly different measures and had different findings

o. One study looked at a two year intervention and another at a one month intervention. Populations differed with one being adults over 75, older than the typical social prescribing population targeted and the other less deprived.

p. One study did not report any confidence interval so cannot assess imprecision

q. One CBA had baseline differences between the intervention and control group and significant loss to follow up of almost 70%.

r. Studies used different measures and had slightly different results.

s. One study did not provide confidence intervals so imprecision could not be assessed.

t. The three RCTs were conducted in a US healthcare setting and may not transfer to other settings. The intervention was also longer and more intense than other social prescribing interventions.

u. Neither study found a statistically significant reductions in hospitalisations or days in hospital but there was a trend towards significance. The third study did not find a difference.

v. One RCT looked at a two year intervention for the over 75s. The other looked at a younger less deprived population than usually targeted for social prescribing interventions. The third at a predominantly Black US population.

w. Neither UK RCT reported confidence intervals or results of statistical analysis making it difficult to comment on precision.

x. The CBA had baseline imbalances between groups and almost 70% loss to follow up

y. The baseline attendance rates between the two groups were very different and findings likely reflect regression to the mean.

Study ID	Primary Outcomes: Results	Secondary Outcomes: Results
Clarke et al, RCT 19	Survival (% at 3.5 years) 73% in Intervention vs. 78% in control. Reported as non-significant.	Activities of daily living, loneliness (Wenger scale), morale (Geriatric Morale Scale), social contact score (Tunstall): no significant changes at 2 years. Information orientation score: not reported. Self-perceived health (% improved): 20% Intervention, 11% Control - reported as significant. HCU: 17% and 12% of both groups had seen GP and PHN respectively in previous month - reported as non-significant.
Grant et al	Mental Health: Anxiety (HADS-A) -1.9 (-3.0 to -0.7)[a] p=0.002, Depression (HADS-D) -0.9 (-1.9 to 0.2) p=0.116. Social Support (Dukes Social Support Scale): Confidant -0.9 (-2.4 to 0.6) p=0.221, Affective -0.3 (-1.2 to 0.7) p=0.594	Quality of life (delighted terrible faces scale): - 0.5 (-0.9 to -0.1) p=0.006. Functional health (COOP/WONCA functional health assessment scale): Pain -0.5 (-0.8 to -0.1), Physical fitness -0.3 (-0.6 to 0.05) p=0.98, Feelings -0.5, (-0.8 to -0.2), Daily Activities -0.5 (-0.6 to -0.2) p=0.001, Social Activities -0.3 (-0.6 to 0.1) p=0.196, Change in health -0.3 (-0.6 to -0.03) p=0.03, Overall Health -0.4 (-0.7 to -0.1) p=0.003. HCU: both groups had similar contacts with the PCT, but the intervention group were reported as having more prescriptions, including mental health prescriptions and fewer referrals to general and mental health services, although no statistical analysis was performed.
Kangovi et al, 2018	Health Related Quality of Life (HRQoL), Physical Health Component (SF-12-V2 PCS) -0.7 (-2.2 to 0.7)[b] p=0.3	HRQoL Mental Health Component (SF-12-V2 MCS) 0.8 (-1.1 to 2.6)b p=0.3 . Patient Activation (PAM score): 1.9 (-0.1 to 3.8) p= 0.06. Chronic disease control: HBA1c -0.2 (-1.3 to 0.9), BMI -0.2 (-0.7 to 0.4), CPD -0.5 (-2.2 to 1.2), SBP -6.3 (-14.3 to 1.8). Patient reported quality of primary care: Intervention group were more likely to report highest rating for quality comprehensive care and supportiveness for self-management - risk difference 0.12 p=<0.001. HCU: Intervention group had fewer repeat admissions -0.24 (-0.40 to -0.07) p=0.02 and 30d readmissions -0.17 (-0.32 to -0.02) p=0.04, fewer total hospital days (300 vs 471) and statistically non significant fewer total hospitalisations -0.3 (-0.6 to 0.0) p=0.07 and shorter length of stay -3.1 (-6.3 to 0.2) p=0.06.
Kangovi et al, 2017	Change in chronic disease control: HBA1C −0.2 (−1.3 to 0.9) [c], BMI −0.2 (−0.7 to 0.4), CPD −0.5 (−2.2 to 1.2), SBP −6.3 (−14.3 to 1.8) p=0.08	Achievement of chronic disease management goals (% achieved) 18.3% vs 17.2% p=0.81 . HRQoL Physical Health Component (change in SF-12-V2 PCS): 0.9 vs 0.5 p=0.67 and HRQoL Mental Health Component (change in SF-12- V2 MCS) 2.3 vs -0.2 p= 0.008. Patient activation (change in PAM) 2.2 vs 1.5 p=0.66. Proportion of people reporting high quality of patient centred care that was comprehensive (49.2% vs 39.7% p=0.01) and supportive of disease management (62.9% vs 38% p=0.001). HCU: Intervention group had a total of 68 hospitalisations with 278 hospital days vs 98 hospitalisations and 414 hospital days in the control p=0.17.
Carnes et al	Not specified	Self rated health (scale 1 to5): 0.127 (−0.221 to 0.9475)[d] . Mental health, anxiety (HADS-A): −0.119 (−0.847 to 1.609). Mental health, depression (HADS-D): 0.857 (−0.737 to 2.451) Wellbeing (Scale of 0-6 in last week): −0.013 (−0.623 to 0.596) . Positive and active engagement in life (HeiQ Scale 0-20): −0.073 (−1.278 to 1.131). Number of regular activities (range 0-6): -0.897 (-1.729 to -0.065) p=0.035. HCU: A&E visits in the previous 3 months (mean (SD): Intervention 0.3 (0.68), Control 0.5 (1.15), but no baseline rate reported for the intervention group. Annual GP consultation rate before referral decreased in the intervention group and slightly increased in the control group, but there were significant baseline differences- Intervention 8.3 to 7.3, p=0.001, Control 2.9 to 3.3 p=0.014 and p=<0.001 for between group differences at baseline and follow up. The intervention group were prescribed

		significantly more medications at baseline and follow up than control p <0.001.
Dickens et al	Health Related Quality of Life, Mental Health Component (SF-12 MCS) 0.1 (-1.9, 2.1)[e]	HRQoL Physical Health Component (SF-12 PCS): 0.1 (-1.9 to 2.10) p=0.9. HRQoL (EQ-5D-3L): -0.09 (-0.14 to -0.03) p=<0.001. Depression (GDS): 0.2 (-0.2 to 0.7) p=0.29. Social Support (MOS-6): 0.03 (-0.2 to 0.2) p=0.75. Social Activities: No significant differences were reported between groups for number of friends/family, club/group membership or frequency of get together with friends/family. The intervention group were less likely to report getting along with others (OR 0.6 (0.4 to 0.9) p<0.01). Social Participation (General Household Survey items on housework, transport, childcare, advice, emotional support) was not different between groups.
Mercer et al	Health Related Quality of Life (EQ-5D-5L) 0.008 (–0.028 to 0.045)[f]	Well-being (ICECAP-A): –0.011 (–0.039 to 0.016) p=0.411. Mental health, anxiety (HADS-A): –0.41 (–0.99 to 0.18) p=0.172. Mental health, depression (HADS-D): 0.09 (–0.49 to 0.68) p=0.753. Work and social adjustment scale: 0.05 (-1.37 to 1.48) p=0.940. Self-reported lifestyle activities (smoking, alcohol, exercise): no difference between groups.

[a] Mean Difference (95% CI) adjusted for baseline results. [b] Longitudinal estimated difference in difference (95% CI) from 6 to 9 months adjusted for site and chronic disease. [c] Difference in difference (95% CI) controlled for baseline results and any imbalanced baseline variables [d] Mean difference (95% CI) adjusted for age, sex, ethnicity, employment status and living arrangement. [e] Mean difference (95% CI) adjusted for employment status, accommodation type and living circumstances. [f] Mean difference (95% CI) adjusted for age, sex, SIMD, comorbidity, and significant baseline outcome measures as covariates and includes practice identifier as a random effects term.

SF-12V2= Short Form Health Survey, is often used as a health related quality of life measure, with Physical (PCS) and Mental (MCS) health components reported separately on a scale of 0-100 with 100 representing maximal health. EQ-5D-5L=a standardized measure of self-reported health-related quality of life that assesses 5 dimensions at 5 levels of severity where 1 is the preferred state of health. EQ-5D-3L=an earlier version of EQ-5D-5L with 3 levels. GDS =Geriatric Depression Scale, a screening tool for depression in older people with a score of 4 or more indicating possible depression. HADS = Hospital Anxiety and Depression Scale measured on a scale of 0-42 where a higher score indicates worse mental health. HADS-A=Hospital Anxiety and Depression Scale, Anxiety, where a score above 10 indicates possible caseness; HADS-D=Hospital Anxiety and Depression Scale, Depression, where a score above 10 indicates possible caseness. Duke UNC Functional Social support scale measures an individual's social network, a higher score indicates stronger supports. MOS-6 Social support (six items from the Medical Outcomes Study Social Support Survey [MOS-SSS] where a higher score on scale of 1-6 indicates more support. ICECAPA= Investigating Choice Experiments for the Preferences of Older People Capability Measure for Adults, a capability based wellbeing measure for adults where 0 is no capability and 1 is full capability; WASAS = Work and Social Adjustment Scale that measures impact of mental health problems on daily life with higher scores denoting a greater impact.

BMI=body mass index, CPD= cigarettes per day, SBP=systolic blood pressure, HbA1C=glycosylated haemoglobin, decrease denotes improvement.

PRISMA 2020 for Abstracts Checklist

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	Yes
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	
Synthesis of results	6	Specify the methods used to present and synthesise results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	Yes
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	Yes
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	Yes
Registration	12	Provide the register name and registration number.	Yes

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

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