STUDY PROTOCOL

REVISED Physicians shortage in primary care: a protocol for updating a systematic review of recruitment and retention strategies

[version 2; peer review: 2 approved]

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Abstract

Background

The global shortage of primary care physicians (PCPs) poses a critical threat to healthcare accessibility and system performance in high-income countries. Previous reviews have documented a wide range of recruitment and retention (R&R) strategies, but the evidence base remains fragmented, outdated, and geographically uneven. In light of demographic transitions, the increasing burden of multimorbidity, and evolving models of care accelerated by the COVID-19 pandemic, an updated synthesis is needed to guide sustainable and context-sensitive workforce policies.

Methods

This systematic review will follow PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines and is registered with PROSPERO (International Prospective Register of Systematic Reviews) (CRD420251008508). MEDLINE (via PubMed), Embase, and CENTRAL (Cochrane Central Register of Controlled Trials), will be searched for quantitative studies published from February 2015 onward, without language restrictions. Eligible studies will evaluate interventions designed to improve the recruitment and/or retention of PCPs, medical students, or residents in high-

Open Peer Review

Approval Status ✓ ✓

	1	2
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version 1 05 Feb 2026	✓ view	✓ view

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Any reports and responses or comments on the article can be found at the end of the article.

income countries. Primary outcomes will include the number of physicians recruited or retained and the duration of retention. Secondary outcomes will cover career intentions, cost-effectiveness, physician satisfaction and well-being, and workforce stability. Two reviewers will independently conduct study selection, data extraction, and risk of bias assessment using validated NIH (National Institutes of Health) quality assessment tools. Findings will be synthesized narratively, with thematic grouping by intervention type, career stage, and contextual factors (e.g., rurality, health system model).

Discussion

This review will provide an updated and comprehensive assessment of R&R strategies for PCPs in high-income countries. By examining intervention logic, outcomes, and contextual modifiers, it will identify which approaches are most effective under specific conditions. The results aim to inform policymakers, educators, and workforce planners in designing targeted, scalable, and context-sensitive strategies to strengthen primary care workforce resilience.

Systematic Review Registration: PROSPERO registration number: CRD420251008508.

Keywords
Primary care physicians, Recruitment, Retention, Workforce, High-income countries, Policy, General practice, Family medicine

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REVISED **Amendments from Version 1**

This revised version incorporates clarifications made in response to the peer review reports, without altering the scope, eligibility criteria, or objectives of the protocol. Two changes have been made to the manuscript text. First, the *Data synthesis* section has been expanded to specify the decision rules for quantitative synthesis: meta-analysis will be considered only when at least two studies report sufficiently comparable outcomes (in terms of population, intervention, and outcome definition) with poolable effect estimates, using a random-effects model; statistical heterogeneity will be assessed using the I^2 statistic and interpreted alongside clinical and methodological judgement on comparability, with narrative synthesis adopted where pooling is inappropriate. Second, the *Amendments* section has been clarified to state that any important amendments to the protocol — including changes to eligibility criteria, outcomes, search strategy, or synthesis methods — will be documented transparently in the PROSPERO record and reported in the final review, with the date and rationale for each amendment. No changes were made to the abstract, author list, figures, tables, or references. Point-by-point responses to the reviewers are provided separately alongside the review reports.

Any further responses from the reviewers can be found at the end of the article

Introduction

A global crisis is unfolding as the shortages in the health workforce[1–5] compounded by the unequal distribution[6–13] undermine the foundations of accessible and effective healthcare and create substantial barriers to the equitable delivery of services across populations.[1,6,14,15] At the same time, demographic transitions—most notably the population ageing[16,17]—and the increasing burden of multimorbidity[18,19] are amplifying pressures on health systems, making the need for strong, resilient, and adequately staffed Primary Health Care more relevant than ever.[20–23]

Primary Care Physicians (PCPs) are the cornerstone of healthcare systems, delivering first-contact, comprehensive, continuous and coordinated care.[24] A higher density of PCPs correlates with improved population health, increased life expectancy,[25–27] and lower mortality.[28–33] Greater availability of family physicians contributes to earlier cancer diagnoses (breast,[34] colon,[35–38] cervical,[39] melanoma[40]) and fewer hospital admissions.[30,41] Continuity of care enhances satisfaction, compliance, and reduces ER visits and hospitalizations.[42–46] Continuity of care and first-contact care also improve efficiency, reducing consultation time, lab test use, and overall healthcare costs.[47–50]

The challenges surrounding the PCPs workforce supply–demand imbalance are complex and multidimensional: while shortages have been consistently reported across different countries,[51–53] the unequal distribution of physicians[6–13] amplifies the problem, with particularly severe implications in rural areas and socio-economically disadvantaged urban and suburban settings.[6,7,12,54–56] Already in 1971, Hart formalized this pattern as the inverse care law—'the availability of good medical care tends to vary inversely with the need for it in the population served'—showing that areas with the greatest morbidity and mortality are served by general practitioners with larger lists, heavier workloads, and less hospital support than healthier areas.[12]

Several factors have been identified as contributors to the PCP shortages, including increasing workload,[57,58] job dissatisfaction,[58,59] increasing administrative burden[58,59] and a perceived lack of career development opportunities[58] leading to leaving practice[58] or early retirement.[59] Furthermore, multiple studies[7,9–11] have addressed the determinants of physician's unequal distribution: a systematic review conducted in 2020[13] explored the factors influencing physician retention in rural and underdeveloped areas, identifying six main categories: financial, professional, working conditions, living conditions, cultural, and personal factors.

In 2010, the WHO issued global policy recommendations to increase access to health workers in remote and rural areas establishing a GRADE-informed framework[6] to select, design, implement, monitor, and evaluate rural retention policies, with emphasis on relevance, acceptability, affordability, effectiveness (including complementarities and unintended effects), and impact. Within this context a wide range of recruitment and retention have been documented in multiple reviews,[54,55,60,61] including financial incentives, educational interventions, curricular reforms, and policy initiatives to improve career pathways and work environments, with emerging evidence underscoring the importance of multifaceted strategies.[62] A recent umbrella review in pre-print in 2025[63] mapped 12 systematic reviews (with searches up to 2019) and found a sparse, geographically concentrated evidence base: the most consistent signals favoured continuous professional development, safe and supportive working environments, and career-development programmes, while effects of financial incentives were mixed and formal evaluations remained limited—thereby underscoring the need for updated, retention-focused syntheses.

The COVID-19 pandemic intensified burnout and attrition and reshaped models of care, generating persistent backlogs and altering the conditions under which PCPs work,[64] with rapid shifts in working practices, reduced opportunities for face-to-face care, a widespread use of remote consultations, and a policy-enabled scale-up of telemedicine.[65] In parallel Artificial Intelligence is expanding the tools available to clinicians and health systems and may empower new models of care; however, its integration into primary care remains nascent and demands robust governance, workforce training, and equity-focused implementation.[66,67]

In this context, a new, comprehensive systematic review is needed to map and appraise current recruitment and retention strategies for PCPs in high-income countries. Our goal is to deliver actionable, evidence-informed insights to policy-makers and educators and to guide sustainable, context-aware solutions that bolster primary-care workforce resilience.

Objectives

This protocol outlines a systematic review of quantitative evaluations of strategies to recruit and retain primary care physicians (PCPs) in high-income countries (HICs), updating the evidence base from 2015 onward to inform policy and training decisions.

The review pursues the following objectives:

1. Determine which strategies—policy, financial, educational/training, regulatory, organizational, and multi-component packages—are associated with improved recruitment and/or retention of PCPs in HICs.

2. Map and compare definitions and measures of "recruitment" and "retention" used across studies and contexts, identifying points of divergence that affect comparability and synthesis.

3. Examine the influence of health-system models (e.g., public vs private/mixed; single- vs multi-payer; gate-keeping arrangements) on the selection, implementation, and effectiveness of recruitment and retention strategies.

4. Assess contextual modifiers—such as rurality/remote status and area-level deprivation—shaping the adoption and effectiveness of recruitment and retention strategies.

Protocol

Study design and registry

This review will adhere to PRISMA 2020[68] and has been registered on PROSPERO (CRD420251008508). A populated PRISMA-P checklist is provided as an Extended Data on OSF (DOI 10.17605/OSF.IO/Z6AFJ). We will include studies from high-income countries as listed from the Organization for Economic Co-operation and Development (OECD), and limit inclusion to articles published from February 2015 onward to reflect the contemporary context.

Review question and PICO

Component	Description
Population	Primary care physicians (general practitioners, family physicians); Medical students and residents in general practice/family medicine
Intervention	Any intervention explicitly designed to improve recruitment and/or retention in primary care
Comparator	No intervention; Alternative intervention
Outcomes	Primary outcomes: Number/proportion of physicians recruited or retained; Duration of retention Secondary outcomes: Future career intentions; Physician satisfaction and well-being; Workforce stability and accessibility to primary care services; Cost-effectiveness
Study Design	Quantitative studies only

Eligibility criteria

Study design

This systematic review will include any quantitative studies that evaluate the impact of interventions or strategies aimed at improving the recruitment and/or retention of primary care physicians. Given the complexity and diversity of workforce interventions, a broad range of study designs will be considered eligible, including:

- Randomized controlled trials (RCTs) and cluster RCTs
- Quasi-experimental studies, including non-randomized controlled trials
- Controlled before-and-after (CBA) studies
- Interrupted time series (ITS) analyses
- Observational studies, including prospective and retrospective cohort studies, case-control studies, and cross-sectional surveys that report quantitative data on relevant outcomes

Studies must report measurable outcomes related to recruitment or retention. Qualitative studies, mixed-methods studies without extractable quantitative results, opinion pieces, narrative reviews, editorials, and conference abstracts without full text will be excluded.

Population

This systematic review will include studies involving individuals at various stages of the primary care medical career pathway. Specifically, eligible populations are:

- Primary care physicians, including general practitioners, family physicians, and other generalist doctors who provide first-contact, continuous, comprehensive, and coordinated care within a primary care setting;
- Medical students enrolled in undergraduate medical programs with a declared or potential interest in primary care;
- Residents or specialty trainees undergoing postgraduate training in general practice or family medicine.

Studies focusing on healthcare professionals other than physicians (e.g., nurses, physician assistants), or on physicians not working in primary care (e.g., specialists), will be excluded.

Interventions

This systematic review will include any type of strategy aimed at the recruitment and retention of primary care physicians (General Physicians, General Practitioners, Family Physicians) in high-income countries defined by OECD criteria.

Will be excluded from the review:

- Strategies that do not specifically aim to address the recruitment or retention of primary care physicians or medical students.
- Strategies targeting healthcare professionals other than physicians (e.g., nurses, physician assistants).
- Strategies targeting physicians not working in primary care (e.g., specialists).
- Studies conducted exclusively in low- and middle-income countries, as workforce challenges and healthcare infrastructures in these settings differ significantly from those in high-income countries.
- Studies that do not evaluate a clearly defined intervention or strategy.

Comparator(s)/Control

Where relevant, strategies will be compared against alternative strategies or the absence of a specific strategy. Studies with control groups, including comparisons between different interventions or between intervention and non-intervention groups, will be included when available.

Outcomes and prioritization

The primary outcomes of interest are:

- The number of primary care doctors recruited or retained, defined as the total number of Primary Care Physicians (including General Practitioners, Family Physicians, or Family Doctors) who enter or remain in primary care practice following a specific intervention.
- The duration of retention, measured in the number of years a physician continues to practice in a given location after a specific intervention.

Additional outcomes will be assessed where reported in the included studies. These may include:

- Future career intentions of physicians, such as the expressed likelihood of entering or remaining in primary care practice.
- Cost-effectiveness, including the reported financial investments associated with recruitment and retention programs, and any available economic evaluations.
- Physician satisfaction and well-being, measured through validated instruments or self-reported assessments.
- Workforce stability and accessibility to primary care services, such as reductions in turnover, increases in workforce supply, or improvements in patient access to general practitioners.

Outcome measure	Rationale
Number of Primary Care Physicians recruited or retained	Represents the core metric of workforce growth or stabilization following an intervention; directly reflects the primary objective of recruitment and retention strategies.
Duration of retention (years in practice post-intervention)	Measures long-term impact and sustainability of interventions; captures whether strategies lead to meaningful improvements in physician workforce continuity.
Future career intentions	Assesses anticipated workforce behavior, providing predictive insight into long-term retention trends and physician satisfaction.
Cost-effectiveness of strategies	Essential for policy and planning; allows comparison of interventions not only on outcomes but also on resource efficiency and scalability.
Physician satisfaction and well-being	Indicates perceived impact of interventions; correlates with retention and performance; essential to understand intervention impact beyond numerical workforce data.
Workforce stability and accessibility to primary care	Reflects system-level outcomes; helps evaluate whether interventions contribute to equitable service delivery, especially in underserved or rural areas.

Language

No language restrictions will be applied. For articles published in languages other than English, translation tools; any issues related to translation will be transparently reported in a specific appendix.

Information sources

We will search the following electronic databases: MEDLINE (via PubMed), Embase and CENTRAL. The search will cover all literature from February 2015 to the final search date, with no language restrictions. A draft of the search strategy

for Embase is reported below. To ensure transparency and reproducibility, the full search strategies will be made publicly available on OSF as Extended Data (DOI 10.17605/OSF.IO/Z6AFJ).[69]

Draft search strategy (Embase via Embase.com)

('general practitioner'/exp OR 'general practitioner' OR 'family physician'/exp OR 'family physician' OR 'general practice'/exp OR 'general practice' OR 'general practitioner*':ti OR 'general practitioner*':ab OR 'family physician*':ti OR 'family physician*':ab OR 'family doctor*':ti OR 'family doctor*':ab OR 'primary care physician*':ti OR 'primary care physician*':ab OR 'primary care doctor*':ti OR 'primary care doctor*':ab OR 'primary care provider*':ti OR 'primary care provider*':ab)

AND

('personnel management'/exp OR 'personnel management' OR 'physician engagement'/exp OR 'physician engagement' OR 'retention time'/exp OR 'retention time' OR recruitment*:ti OR recruitment*:ab OR retention*:ti OR retention*:ab OR retain*:ti OR retain*:ab OR 'workforce planning':ti OR 'workforce planning':ab OR 'physician* allocation':ti OR 'physician* allocation':ab OR 'workforce retention':ti OR "workforce retention':ab OR "workforce stability':ti OR "workforce stability':ab OR "physician retention':ti OR "physician retention':ab OR "workplace engagement':ti OR "workplace engagement':ab) AND [humans]/lim AND [2015-2025]/py

Search strategy development and peer-review calibration

The strategy will include both controlled vocabulary terms (e.g., MeSH, Emtree) and free-text keywords related to primary care physicians, recruitment, retention, and high-income countries.

The following bibliographic databases will be searched: MEDLINE (via PubMed), Embase (via embase.com), and CENTRAL (Cochrane Central Register of Controlled Trials). The search will cover studies published from 1 February 2015 onwards, with no end-date or language restrictions, to ensure comprehensive coverage of recent evidence. A second reviewer will independently assess the draft strategy for completeness, appropriateness of terms, syntax errors, use of filters, and inclusion/exclusion logic.

Reference lists of all included studies will be hand-searched to identify additional relevant articles not captured through database searching. Duplicate records will be removed in Rayyan. Zotero (v. 7.0.30) will be used as the citation manager for reference handling and manuscript preparation**.** A detailed search log will be maintained to support transparency and reproducibility.

Study record and selection process

Records retrieved from each database will be exported and imported into Zotero (v. 7.0.30) for reference management. De-duplication will be performed in Rayyan, after which the de-duplicated library will be used for screening and to maintain an audit trail of decisions.

Titles and abstracts will be independently screened by two reviewers (F.C. and B.B.) against the predefined eligibility criteria. Full texts of all studies deemed potentially eligible, or for which there is any uncertainty, will be retrieved and assessed in full.

Any disagreements at the title/abstract or full-text screening stages will be resolved through discussion. If consensus cannot be reached, a third reviewer (D.P.) will be consulted.

The full selection process will be documented using the PRISMA 2020 flow diagram, including the number of records identified, included, and excluded at each phase, with reasons for exclusion clearly reported.

Companion or duplicate publications will be identified through comparison of author lists, sample characteristics, and intervention descriptions, and will be merged or excluded as appropriate to avoid double-counting of data. In cases of missing or unclear data, corresponding authors will be contacted by email (up to three attempts) to request clarification or supplementary information.

Data extraction

Data will be extracted using a standardised form developed and piloted by the review team. Extracted items will include: study design, country, setting, population, intervention characteristics, comparator (if applicable), outcomes related to

recruitment or retention, and key findings. Two reviewers will independently extract data for all included studies; disagreements will be resolved by consensus or, if needed, by a third reviewer (D.P.).

Risk of bias and quality assessment

Risk of bias will be assessed using:

- The Quality Assessment Tools for Case-Control, Cohort, and Cross-Sectional Studies of the National Institute of Health (USA) will be used.
- The Quality Assessment Tools for controlled Studies of the National Institute of Health (USA) will be used.

Data will be assessed independently by at least two people with a process to resolve differences.

Risk of bias will be assessed at the study level. Risk-of-bias judgements will be used to inform about the certainty of evidence assessment.

Data synthesis

Given the expected heterogeneity in study designs, interventions, and outcome definitions, findings will primarily be synthesised narratively. We will use a thematic synthesis to categorise the evidence according to the types of recruitment and retention strategies identified, supported by evidence tables and summary matrices. Where helpful, studies will be grouped by: author/year; country; study design; sample characteristics and population/setting (e.g., early-career vs experienced GPs; rural vs urban); healthcare system model (e.g., publicly funded, mixed, private); intervention category (e.g., financial incentives, educational programmes, workforce policies); outcome measure; and results. Quantitative findings will be summarised descriptively (absolute numbers, percentages, and effect estimates as reported). Because substantial variability in methods and outcomes is anticipated, meta-analysis will be considered only when at least two studies report sufficiently comparable outcomes — in terms of population, intervention, and outcome definition — and effect estimates that can be appropriately pooled. In such cases we will conduct a random-effects meta-analysis. Statistical heterogeneity will be quantified using the I^2 statistic and interpreted together with clinical and methodological judgement on the comparability of the studies; where heterogeneity is substantial or pooling is otherwise inappropriate, results will be presented through narrative synthesis with descriptive statistics.

If quantitative synthesis is feasible, we will conduct a random-effects meta-analysis, selecting effect measures appropriate to the outcome type (RR/OR or MD/SMD). Where needed, we will convert reported statistics to a common effect metric when sufficient information is available, and we will report 95% confidence intervals. Heterogeneity will be assessed using I^2; where pooling is not appropriate, findings will be synthesised narratively. Subgroup and sensitivity analyses will be conducted only if feasible, focusing on the prespecified grouping variables (e.g., career stage, setting, intervention category); meta-regression is not planned.

Meta-bias(es)

Assessment of reporting biases is not planned due to the anticipated heterogeneity and small numbers of studies per outcome. To mitigate potential bias arising from missing or selectively reported results, we will search multiple databases without language restrictions, document the selection process with a PRISMA 2020 flow diagram, extract and report funding sources and authors' conflicts of interest, and discuss any concerns in the Limitations.

Confidence in cumulative evidence

The overall certainty (strength) of the body of evidence will be appraised narratively, as prespecified in the PROSPERO record, using criteria aligned with the GRADE domains. For each primary outcome, we will consider: (i) risk of bias of contributing studies (based on the NIH quality assessment tools), (ii) consistency of findings across studies, (iii) precision/imprecision of effect estimates or descriptive summaries, and (iv) directness/applicability to the review question and settings. A formal assessment of publication bias is not planned; any concerns related to missing or selectively reported results will be discussed narratively. Certainty judgements will be summarised in the text and, where helpful, presented in a descriptive summary table (e.g., a narrative 'Summary of Findings' table).

Amendments

Any important amendments to this protocol, including changes to eligibility criteria, outcomes, search strategy, or synthesis methods, will be documented transparently in the PROSPERO record and reported in the final review, with the date and rationale for each amendment.

Conclusions/Discussion

This review will examine recruitment and retention (R&R) strategies for primary care physicians as active components of workforce change, clarifying how they are designed, implemented, and reported—and how they influence career choice, practice location, and tenure in high-income settings. By analysing intervention logic alongside outcomes, and by mapping definitions of "recruitment" and "retention," the review will identify which elements (e.g., incentives, training pathways, workload redesign, professional support) drive effects, and under what system (financing, gatekeeping) and contextual (rurality, deprivation) conditions they perform best. A structured narrative synthesis will organise findings by strategy type and career stage, translating quantitative results into workforce-relevant metrics to support planning. The resulting evidence will guide the design of more targeted, scalable, and context-sensitive packages, distinguishing core components from adaptable features, and highlighting implementation considerations (acceptability, feasibility, costs) and equity impacts where available. Ultimately, the review aims to inform policy, education, and service planning by providing practical guidance on assembling coherent R&R strategies that strengthen and stabilize the primary-care workforce.

Dissemination

Results of this review will be disseminated through peer-reviewed publications, conference presentations.

Ethics and consent

Not applicable. This study does not involve human participants or primary data collection.

Data and software availability

To ensure transparency and reproducibility, the full search strategies will be made publicly available on OSF as Extended Data (DOI 10.17605/OSF.IO/Z6AFJ).[69]

Underlying data

No data are associated with this article.

Extended data

Open Science Framework (OSF): *Primary care physicians shortage in primary care: An update systematic review of recruitment and retention strategies (protocol).* https://doi.org/10.17605/OSF.IO/Z6AFJ.[69]

The project contains the following extended data:

- search strategy 12 25.pdf (full database search strategies: MEDLINE/PubMed, Embase, CENTRAL).
- Prisma P Checklist.pdf (completed PRISMA-P 2015 checklist).

Software: Reference management and citation handling will be performed using Zotero (v. 7.0.30), and screening (including de-duplication) will be conducted in Rayyan.

Reporting guidelines

This protocol follows the PRISMA-P 2015 statement. The completed PRISMA-P checklist is available on OSF as Extended Data (DOI 10.17605/OSF.IO/Z6AFJ; License CC-BY Attribution 4.0 International).[69]

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References

1. World Health Organization: *Global Strategy on Human Resources for Health: Workforce 2030.* World Health Organization; 2016. Accessed August 11, 2025.
Reference Source

2. **Addressing the 18 million health worker shortfall – 35 concrete actions and 6 key messages.** Accessed August 24, 2025.
Reference Source

3. The Lancet Global Health: **Health-care workers must be trained and retained.** *Lancet Glob. Health.* 2023; **11**(5): e629.
Publisher Full Text

4. Agyeman-Manu K, Ghebreyesus TA, Maait M, *et al.*: **Prioritising the health and care workforce shortage: protect, invest, together.** *Lancet Glob. Health.* 2023; **11**(8): e1162–e1164.
PubMed Abstract | Publisher Full Text | Free Full Text

5. State of the U.S. Health Care Workforce: 2024.

6. World Health Organization: **Increasing access to health workers in remote and rural areas through improved retention: global policy recommendations.** 2010; 71.

7. **Geographic Imbalances in Doctor Supply and Policy Responses.** 2014; **69**.
Publisher Full Text

8. Kharazmi E, Bordbar S, Bordbar N, *et al.*: **Are Doctors Equally Distributed Throughout the World?** *Iran. J. Public Health.* 2024; **53**(5): 1155–1163.
PubMed Abstract | Publisher Full Text | Free Full Text

9. Zurn P, Dal Poz MR, Stilwell B, *et al.*: **Imbalance in the health workforce.** *Hum. Resour. Health.* 2004; **2**(1): 13.
PubMed Abstract | Publisher Full Text | Free Full Text

10. Horev T, Pesis-Katz I, Mukamel DB: **Trends in geographic disparities in allocation of health care resources in the US.** *Health Policy.* 2004; **68**(2): 223–232.
PubMed Abstract | Publisher Full Text

11. Dussault G, Franceschini MC: **Not enough there, too many here: understanding geographical imbalances in the distribution of the health workforce.** *Hum. Resour. Health.* 2006; **4**: 12.
PubMed Abstract | Publisher Full Text | Free Full Text

12. Hart JT: **The inverse care law.** *Lancet Lond. Engl.* 1971; **1**(7696): 405–412.
Publisher Full Text

13. Mohammadiaghdam N, Doshmangir L, Babaie J, *et al.*: **Determining factors in the retention of physicians in rural and underdeveloped areas: a systematic review.** *BMC Fam. Pract.* 2020; **21**: 216.
PubMed Abstract | Publisher Full Text | Free Full Text

14. Health workforce: Accessed August 24, 2025.
Reference Source

15. Pittman P, Chen C, Erikson C, *et al.*: **Health Workforce for Health Equity.** *Med. Care.* 2021; **59**: S405–S408.
PubMed Abstract | Publisher Full Text | Free Full Text

16. **World Population Prospects 2024: Summary of Results.**

17. Reeves D, Pye S, Ashcroft DM, *et al.*: **The challenge of ageing populations and patient frailty: can primary care adapt?** *BMJ.* August 28, 2018; **362**: k3349.
PubMed Abstract | Publisher Full Text

18. Skou ST, Mair FS, Fortin M, *et al.*: **Multimorbidity.** *Nat. Rev. Dis. Primers.* 2022; **8**(1): 48.
PubMed Abstract | Publisher Full Text | Free Full Text

19. Tran PB, Kazibwe J, Nikolaidis GF, *et al.*: **Costs of multimorbidity: a systematic review and meta-analyses.** *BMC Med.* 2022; **20**(1): 234.
PubMed Abstract | Publisher Full Text | Free Full Text

20. Foo CD, Logan K, Eu E, *et al.*: **Starfield's 4Cs of NCD management in primary healthcare: a conceptual framework development from a case study of 19 countries.** *BMJ Glob. Health.* 2025; **10**(1).
PubMed Abstract | Publisher Full Text | Free Full Text

21. Henderson DAG, Donaghy E, Dozier M, *et al.*: **Understanding primary care transformation and implications for ageing populations and health inequalities: a systematic scoping review of new models of primary health care in OECD countries and China.** *BMC Med.* 2023; **21**(1): 319.
PubMed Abstract | Publisher Full Text | Free Full Text

22. World Health Organization: **The world health report 2008: primary health care now more than ever.** *Rapp Sur Santé Dans Monde 2008 Soins Santé Prim - Maintenant Plus Que Jamais.* 2008; 119.

23. OECD: *Realising the Potential of Primary Health Care.* OECD; 2020.
Publisher Full Text

24. Starfield B, Shi L, Macinko J: **Contribution of Primary Care to Health Systems and Health.** *Milbank Q.* 2005; **83**(3): 457–502.
PubMed Abstract | Publisher Full Text | Free Full Text

25. Shi L: **The relationship between primary care and life chances.** *J. Health Care Poor Underserved.* 1992; **3**(2): 321–335.
Publisher Full Text

26. Shi L: **Primary care, specialty care, and life chances.** *Int J Health Serv Plan Adm Eval.* 1994; **24**(3): 431–458.
Publisher Full Text

27. Vogel RL, Ackermann RJ: **Is primary care physician supply correlated with health outcomes?** *Int J Health Serv Plan Adm Eval.* 1998; **28**(1): 183–196.
Publisher Full Text

28. Shi L, Macinko J, Starfield B, *et al.*: **The relationship between primary care, income inequality, and mortality in US States, 1980-1995.** *J. Am. Board Fam. Pract.* 2003; **16**(5): 412–422.
PubMed Abstract | Publisher Full Text

29. Mansfield CJ, Wilson JL, Kobrinski EJ, *et al.*: **Premature mortality in the United States: the roles of geographic area, socioeconomic status, household type, and availability of medical care.** *Am. J. Public Health.* 1999; **89**(6): 893–898.
PubMed Abstract | Publisher Full Text | Free Full Text

30. Gulliford MC: **Availability of primary care doctors and population health in England: is there an association?** *J. Public Health Med.* 2002; **24**(4): 252–254.
PubMed Abstract | Publisher Full Text

31. Basu S, Berkowitz SA, Phillips RL, *et al.*: **Association of Primary Care Physician Supply With Population Mortality in the United States, 2005-2015.** *JAMA Intern. Med.* 2019; **179**(4): 506–514.
PubMed Abstract | Publisher Full Text | Free Full Text

32. Cho YG: **Supply of Primary Care Physicians: A Key Strategy to Reduce Population Mortality.** *Korean J Fam Med.* 2024; **45**(2): 59–60.
PubMed Abstract | Publisher Full Text | Free Full Text

33. Macinko J, Starfield B, Shi L: **Quantifying the health benefits of primary care physician supply in the United States.** *Int J Health Serv Plan Adm Eval.* 2007; **37**(1): 111–126.
PubMed Abstract | Publisher Full Text

34. Ferrante JM, Gonzalez EC, Pal N, *et al.*: **Effects of physician supply on early detection of breast cancer.** *J. Am. Board Fam. Pract.* 2000; **13**(6): 408–414.
PubMed Abstract | Publisher Full Text

35. Roetzheim RG, Pal N, Gonzalez EC, *et al.*: **The effects of physician supply on the early detection of colorectal cancer.** *J. Fam. Pract.* 1999; **48**(11): 850–858.
PubMed Abstract

36. Fletcher RH: **Successful colorectal cancer screening starts with primary care.** *Rev. Gastroenterol. Disord.* 2002; **2**(Suppl 1): S27–S34.

37. Hanks H, Veitch C, Harris M: **Colorectal cancer management - the role of the GP.** *Aust. Fam. Physician.* 2008; **37**(4): 259–261.
PubMed Abstract

38. Cole SR, Young GP, Byrne D, *et al.*: **Participation in screening for colorectal cancer based on a faecal occult blood test is improved by endorsement by the primary care practitioner.** *J. Med. Screen.* 2002; **9**(4): 147–152.
PubMed Abstract | Publisher Full Text

39. Campbell RJ, Ramirez AM, Perez K, *et al.*: **Cervical cancer rates and the supply of primary care physicians in Florida.** *Fam. Med.* 2003; **35**(1): 60–64.
PubMed Abstract

40. Roetzheim RG, Pal N, van Durme DJ, *et al.*: **Increasing supplies of dermatologists and family physicians are associated with earlier stage of melanoma detection.** *J. Am. Acad. Dermatol.* 2000; **43**(2 Pt 1): 211–218.
PubMed Abstract | Publisher Full Text

41. Parchman ML, Culler SD: **Preventable hospitalizations in primary care shortage areas. An analysis of vulnerable Medicare beneficiaries.** *Arch. Fam. Med.* 1999; **8**(6): 487–491.
PubMed Abstract | Publisher Full Text

42. Ionescu-Ittu R, McCusker J, Ciampi A, *et al.*: **Continuity of primary care and emergency department utilization among elderly people.** *CMAJ Can Med Assoc J J Assoc Medicale Can.* 2007; **177**(11): 1362–1368.
PubMed Abstract | Publisher Full Text | Free Full Text

43. Freeman G, Hjortdahl P: **What future for continuity of care in general practice?** *BMJ.* 1997; **314**(7098): 1870–1873.
PubMed Abstract | Publisher Full Text | Free Full Text

44. Mainous AG, Gill JM: **The importance of continuity of care in the likelihood of future hospitalization: is site of care equivalent to a primary clinician?** *Am. J. Public Health.* 1998; **88**(10): 1539–1541.
PubMed Abstract | Publisher Full Text | Free Full Text

45. Rosenblatt RA, Wright GE, Baldwin LM, *et al.*: **The effect of the doctor-patient relationship on emergency department use among the elderly.** *Am. J. Public Health.* 2000; **90**(1): 97–102.
PubMed Abstract | Publisher Full Text | Free Full Text

46. Weiss LJ, Blustein J: **Faithful patients: the effect of long-term physician-patient relationships on the costs and use of health care by older Americans.** *Am. J. Public Health.* 1996; **86**(12): 1742–1747.
PubMed Abstract | Publisher Full Text | Free Full Text

47. Forrest CB, Starfield B: **Entry into primary care and continuity: the effects of access.** *Am. J. Public Health.* 1998; **88**(9): 1330–1336.
PubMed Abstract | Publisher Full Text | Free Full Text

48. Hjortdahl P, Borchgrevink CF: **Continuity of care: influence of general practitioners' knowledge about their patients on use of resources in consultations.** *BMJ.* 1991; **303**(6811): 1181–1184.
PubMed Abstract | Publisher Full Text | Free Full Text

49. Raddish M, Horn SD, Sharkey PD: **Continuity of care: is it cost effective?** *Am. J. Manag. Care.* 1999; **5**(6): 727–734.
PubMed Abstract

50. Roos NP, Carrière KC, Friesen D: **Factors influencing the frequency of visits by hypertensive patients to primary care physicians in Winnipeg.** *CMAJ Can Med Assoc J J Assoc Medicale Can.* 1998; **159**(7): 777–783.

51. **The Complexities of Physician Supply and Demand: Projections From 2021 to 2036.** 2021.

52. Majeed A: **Shortage of general practitioners in the NHS.** *BMJ.* July 10, 2017; j3191.
Publisher Full Text

53. van den Bussche H: **Die Zukunftsprobleme der hausärztlichen Versorgung in Deutschland: Aktuelle Trends und notwendige Maßnahmen.** *Bundesgesundheitsbl. Gesundheitsforsch. Gesundheitsschutz.* 2019; **62**(9): 1129–1137.
PubMed Abstract | Publisher Full Text

54. Goodfellow A, Ulloa JG, Dowling PT, *et al.*: **Predictors of Primary Care Physician Practice Location in Underserved Urban or Rural Areas in the United States: A Systematic Literature Review.** *Acad Med J Assoc Am Med Coll.* 2016; **91**(9): 1313–1321.
PubMed Abstract | Publisher Full Text | Free Full Text

55. Bes JM, Flinterman LE, González AI, *et al.*: **Recruitment and retention of general practitioners in European medical deserts: a systematic review.** *Rural Remote Health.* 2023; **23**(1): 7477.
PubMed Abstract | Publisher Full Text

56. Colman C: **Rural health is a crisis that can be solved, here and now.** *Aust. J. Rural Health.* 2022; **30**(1): 127–128.
PubMed Abstract | Publisher Full Text

57. Lawson E: **The Global Primary Care Crisis.** *Br J Gen Pract J R Coll Gen Pract.* 2023; **73**(726): 3.
PubMed Abstract | Publisher Full Text | Free Full Text

58. Long L, Moore D, Robinson S, *et al.*: **Understanding why primary care doctors leave direct patient care: a systematic review of qualitative research.** *BMJ Open.* 2020; **10**(5): e029846.
PubMed Abstract | Publisher Full Text | Free Full Text

59. Doran N, Fox F, Rodham K, *et al.*: **Lost to the NHS: a mixed methods study of why GPs leave practice early in England.** *Br J Gen Pract J R Coll Gen Pract.* 2016; **66**(643): e128–e135.
PubMed Abstract | Publisher Full Text | Free Full Text

60. Marchand C, Peckham S: **Addressing the crisis of GP recruitment and retention: a systematic review.** *Br. J. Gen. Pract.* 2017; **67**(657): e227–e237.
PubMed Abstract | Publisher Full Text | Free Full Text

61. Ogden J, Preston S, Partanen RL, *et al.*: **Recruiting and retaining general practitioners in rural practice: systematic review and meta-analysis of rural pipeline effects.** *Med. J. Aust.* 2020; **213**(5): 228–236.
PubMed Abstract | Publisher Full Text

62. Verma P, Ford JA, Stuart A, *et al.*: **A systematic review of strategies to recruit and retain primary care doctors.** *BMC Health Serv. Res.* 2016; **16**(1): 126.
PubMed Abstract | Publisher Full Text | Free Full Text

63. Jefferson L, Golder S, Castro A, *et al.*: **General practice workforce retention strategies: an umbrella review.** January 21, 2025.
Publisher Full Text

64. Jefferson L, Golder S, Heathcote C, *et al.*: **GP wellbeing during the COVID-19 pandemic: a systematic review.** *Br. J. Gen. Pract.* 2022; **72**(718): e325–e333.
PubMed Abstract | Publisher Full Text | Free Full Text

65. OECD: *The COVID-19 Pandemic and the Future of Telemedicine.* OECD; 2023.
Publisher Full Text

66. Yousefi F, Dehnavieh R, Laberge M, *et al.*: **Opportunities, challenges, and requirements for Artificial Intelligence (AI) implementation in Primary Health Care (PHC): a systematic review.** *BMC Prim Care.* 2025; **26**(1): 196.
PubMed Abstract | Publisher Full Text | Free Full Text

67. *Ethics and Governance of Artificial Intelligence for Health: WHO Guidance.* World Health Organization; 1st ed. 2021.

68. Page MJ, McKenzie JE, Bossuyt PM, *et al.*: **The PRISMA 2020 statement: an updated guideline for reporting systematic reviews.** March 29, 2021.
Publisher Full Text

69. Federico C: **Physicians shortage in primary care: An update systematic review of recruitment and retention strategies.**
Publisher Full Text

Open Peer Review

Current Peer Review Status: ✔ ✔

Version 2

Reviewer Report 23 June 2026

https://doi.org/10.5256/f1000research.204029.r495285

✔ **Ferdinando Petrazzuoli**
Lund University, Malmö, Sweden

Thank you to the authors for properly addressing all the points raised in the first release

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Expert in research in primary care

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 26 May 2026

https://doi.org/10.5256/f1000research.192678.r486296

✔ **Ferdinando Petrazzuoli**
Lund University, Malmö, Sweden

1. Constructive assessment for the authors
This manuscript presents a protocol for an updated systematic review of recruitment and retention strategies for primary care physicians in high-income countries. The topic is timely and important, given persistent primary care workforce shortages, unequal geographical distribution

of physicians, increasing demand from ageing and multimorbidity, and changes in care delivery following COVID-19.
The rationale is clear and well supported. The authors effectively explain why an updated synthesis is needed, particularly because previous reviews are now dated, geographically uneven, and may not fully reflect recent workforce pressures, digital transformation, or post-pandemic working conditions. The objectives are relevant and appropriately aligned with the proposed review question.
The protocol is generally well designed. It is registered in PROSPERO, follows PRISMA guidance, uses broad but justified eligibility criteria, and includes independent screening, extraction, and risk-of-bias assessment by two reviewers. The planned narrative synthesis is appropriate given the expected heterogeneity in interventions, outcomes, and study designs. The inclusion of contextual modifiers such as rurality, deprivation, and health-system model is a strength, as recruitment and retention interventions are highly context dependent.
I have several recommendations that could further strengthen the protocol:
First, the authors could provide clearer operational definitions of "recruitment" and "retention." Although the protocol states that definitions will be mapped across studies, pre-specifying categories or minimum criteria would improve consistency during screening, extraction, and synthesis.
Second, the authors should clarify the criteria for deciding whether meta-analysis is feasible. The protocol currently states that meta-analysis will be considered where outcomes are sufficiently comparable, but more detail would be useful, for example regarding minimum numbers of studies, acceptable outcome similarity, and how heterogeneity will influence decisions.
Third, the authors may wish to include a simple conceptual framework linking intervention categories, mechanisms of action, intermediate outcomes, and final workforce outcomes. This would help readers understand how financial, educational, regulatory, organisational, and multi-component strategies are expected to influence recruitment and retention.
Fourth, the planned assessment of certainty of evidence could be described more explicitly. The protocol mentions GRADE-aligned domains, but a more structured approach, even if narrative rather than fully formal GRADE, would improve transparency.
Finally, given the broad scope of the review, the authors could explain how they will prioritise findings if the evidence base is too heterogeneous or extensive. For example, they could pre-specify that primary outcomes, physician-level retention/recruitment outcomes, or higher-quality comparative studies will receive greater interpretive weight.
I was not able to assess the underlying results or conclusions of the planned systematic review, as this is a protocol and no review findings are yet available. I also could not assess the performance of the final search strategy across all databases beyond the information provided in the manuscript and linked supplementary materials.

2. Mandatory reviewer questions

Is the rationale for, and objectives of, the study clearly described?

Yes. The rationale is well developed and the objectives are clearly stated, relevant, and aligned with the research question.

Is the study design appropriate for the research question?

Yes. A systematic review is appropriate, and the inclusion of diverse quantitative study designs is justified by the nature of workforce interventions.

Are sufficient details of the methods provided to allow replication by others?

Yes, with minor reservations. The eligibility criteria, databases, screening process, data extraction, risk-of-bias assessment, and synthesis approach are described in sufficient detail. Replicability would be improved by more detail on meta-analysis feasibility criteria, operational outcome

definitions, and the structured application of certainty-of-evidence assessment.
Are the datasets clearly presented in a usable and accessible format?
Not applicable. This is a study protocol and no dataset has yet been generated.
3. Approval status
Approved with reservations.
The protocol is scientifically sound and suitable for indexing, but the minor methodological clarifications above would improve transparency, reproducibility, and usefulness of the eventual review.
4. Suggested statement to invite the authors to include
I invite the authors to include the following statement in the manuscript:
The authors should clarify that any amendments to the protocol, including changes to eligibility criteria, outcomes, search strategy, or synthesis methods, will be documented transparently in PROSPERO and reported in the final review, with dates and rationales for each amendment.

Is the rationale for, and objectives of, the study clearly described?
Yes

Is the study design appropriate for the research question?
Yes

Are sufficient details of the methods provided to allow replication by others?
Yes

Are the datasets clearly presented in a useable and accessible format?
Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Expert in research in primary care

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 15 Jun 2026
Federico Contu

Dear Dr Petrazzuoli,

Thank you for your careful and constructive appraisal of the protocol, and for your positive overall assessment. We have considered each of your recommendations, and respond point by point below.

Criteria for meta-analysis feasibility.
We agree and have addressed this point. We have expanded the Data synthesis section to specify that meta-analysis will be undertaken only where at least two studies report comparable outcomes amenable to pooling, using a random-effects model. We have further clarified how heterogeneity, assessed via the I^2 statistic and interpreted together with

judgements on the clinical and methodological comparability of studies, will inform the decision between quantitative pooling and narrative synthesis.

Documentation of protocol amendments.
We have adopted this recommendation. We have aligned the Amendments section of the protocol with your suggested wording, clarifying that any important amendments — including changes to eligibility criteria, outcomes, search strategy, or synthesis methods — will be documented transparently in the PROSPERO record and reported in the final review, with the date and rationale for each change.

Operational definitions of "recruitment" and "retention".
As one of the primary objectives of the review (Objective 2) is to map and compare the definitions and measures of "recruitment" and "retention" across studies and contexts, pre-specifying operational definitions at the screening stage would risk constraining the diversity of definitions the review aims to capture, and could lead to the exclusion of relevant studies adopting alternative conceptualisations. We have therefore retained our planned mapping approach, and we will build on its findings to propose operational definitions and a categorisation framework within the final systematic review.

Conceptual framework, structured certainty-of-evidence assessment, and prioritisation of findings. As these refinements relate to the synthesis and interpretation of results rather than to the scientific soundness of the protocol, we will incorporate them at the appropriate stage of the final systematic review — including a conceptual model linking intervention categories, mechanisms of action, and workforce outcomes; a more structured, GRADE-informed narrative assessment of certainty for each primary outcome; and pre-specified criteria for prioritising findings (for example, greater interpretive weight to primary outcomes, physician-level recruitment and retention outcomes, and higher-quality comparative studies) should the evidence base prove broad or heterogeneous. We will keep these points in mind throughout the conduct of the review.

We thank you again for your comments, which have strengthened the protocol.

Competing Interests: No competing interests were disclosed.

Reviewer Report 23 April 2026

https://doi.org/10.5256/f1000research.192678.r466849

Ana Isabel González González
Consejería de Sanidad, Comunidad de Madrid, Madrid, Spain

SUMMARY

This manuscript presents a protocol for a systematic review aiming to update the evidence on recruitment and retention (R&R) strategies for primary care physicians (PCPs) in high-income countries.

The authors justify the need for this work based on persistent and worsening global shortages of PCPs, increasing demand due to population ageing and multimorbidity, limitations of existing evidence (fragmented, outdated, geographically uneven) and system-level changes (COVID-19, digital health, AI)

The planned review will follow PRISMA 2020 guidelines and has been registered in PROSPERO. It will include quantitative studies (2015 onward) from MEDLINE, Embase, and CENTRAL and will evaluate interventions targeting recruitment and/or retention. The review will focus on outcomes such as: Number of physicians recruited/retained, duration of retention, career intentions, satisfaction, cost-effectiveness, and system-level outcomes

The methodology includes: Dual independent screening and extraction, risk of bias assessment using NIH tools, primarily narrative synthesis, with meta-analysis if feasible and consideration of contextual factors (e.g., rurality, health system models)

The study aims to produce policy-relevant, actionable insights for workforce planning.

COMMENTS

Rationale and objectives

Assessment: YES

The rationale is clear, well-structured, and compelling. It integrates epidemiological, health system, and policy arguments. It explicitly identifies gaps in previous reviews (e.g., outdated evidence, lack of contextualisation).

The objectives are clearly stated, structured into four distinct and relevant aims, directly aligned with the research problem

Minor suggestion (not required for scientific soundness): The authors could prioritise objectives (primary vs secondary aims) to improve clarity and focus.

Study design

Assessment: YES

The choice of a systematic review is fully appropriate for the research question.

The design is methodologically sound because it follows established standards (PRISMA, PROSPERO), it includes a broad range of quantitative designs, which is justified given the complexity of workforce interventions and the expected lack of RCTs in this field.

Minor suggestions

Clarify decision rules for meta-analysis feasibility (currently somewhat vague)

Consider explicitly stating how heterogeneity thresholds (e.g., I^2) will influence decisions

Methods and reproducibility

Assessment: YES

The methods are described in sufficient detail to allow replication.

Key elements supporting reproducibility: Clear eligibility criteria (Population, Intervention, Outcomes, Study design), explicit inclusion/exclusion criteria, detailed search strategy (example provided), transparent screening and selection process (dual reviewers, conflict resolution), defined data extraction variables, risk of bias tools specified, planned synthesis methods described.

The inclusion of OSF repository and PRISMA-P checklist further strengthens transparency.

Minor suggestions

Provide more detail on: Data extraction form (template or variables list in supplement), handling of missing data and unclear reporting and clarify whether calibration exercises will be conducted

among reviewers
These are improvements, not requirements for scientific validity.
Other minor comments and suggestions
These do not affect scientific soundness, but could improve clarity and impact.
The manuscript would benefit from improved conceptual clarity through the inclusion of a clearer framework explicitly linking intervention types, their underlying mechanisms of action, and the expected outcomes. While these elements are all present in the protocol, they are not fully integrated into a single conceptual model. Making these relationships more explicit would strengthen the interpretability of the future synthesis and help readers better understand how different strategies are expected to influence recruitment and retention outcomes across contexts.
Regarding outcome definitions, although the manuscript clearly lists primary and secondary outcomes, further standardisation would enhance consistency. In particular, key concepts such as "recruitment" and "retention" may vary substantially across studies in terms of definition and measurement. The authors already acknowledge this issue and plan to map definitions across studies, which is a notable strength. However, the protocol could be further improved by pre-specifying operational definitions or categorisation frameworks in advance, thereby facilitating more structured comparisons and synthesis.
The scope of the review is appropriately ambitious but may raise feasibility challenges. The inclusion of multiple study designs, a wide range of intervention types, and numerous outcomes is justified given the complexity of workforce interventions; however, this breadth is likely to result in substantial heterogeneity. To address this, the authors should clarify how prioritisation will be managed if the evidence base proves too broad or heterogeneous to synthesise meaningfully. For example, outlining criteria for focusing on specific intervention categories, outcomes, or study designs would strengthen the methodological clarity.
In terms of bias and certainty of evidence, the planned use of NIH quality assessment tools is appropriate and aligned with the inclusion of diverse study designs. However, the approach to assessing the overall certainty of evidence using GRADE is described only narratively. The protocol would benefit from a more structured application of GRADE, even if simplified, to ensure transparency and consistency in evaluating the strength of the evidence across outcomes.
No issues have been identified that must be addressed to ensure the scientific soundness of the study. Overall, the protocol is methodologically robust and suitable for indexing in its current form.
In conclusion, this is a scientifically sound protocol of high methodological quality. It addresses an important and timely topic, demonstrates strong methodological rigour, and adheres to best practices in transparency and reproducibility. The manuscript is well-designed and clearly reported, and the proposed review has the potential to make a meaningful contribution to the field.
Final verdict: the manuscript is acceptable as it stands, with only minor improvements suggested.

Is the rationale for, and objectives of, the study clearly described?

Yes

Is the study design appropriate for the research question?

Yes

Are sufficient details of the methods provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?
Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Healthcare services research. Multimorbidity.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 15 Jun 2026

Federico Contu

Dear Dr González González,

Thank you for your careful review, and for considering the protocol scientifically sound and suitable for indexing in its current form. We have considered each of your suggestions and respond point by point below.

Meta-analysis feasibility and heterogeneity thresholds.

We agree with this point and have addressed it. We have expanded the Data synthesis section to specify the decision rules for quantitative synthesis: meta-analysis will be considered only where at least two studies report comparable outcomes with effect estimates that can be appropriately pooled, using a random-effects model. We have also clarified that statistical heterogeneity will be assessed using the I^2 statistic, interpreted alongside clinical and methodological judgement on comparability, and that where heterogeneity is substantial or pooling is otherwise inappropriate, findings will be synthesized narratively.

Operational definitions of "recruitment" and "retention".

We would respectfully note that one of the primary objectives of this review (Objective 2) is precisely to map and compare the definitions and measures of "recruitment" and "retention" used across studies and contexts, and to identify the points of divergence that affect comparability. Pre-specifying operational definitions at the screening stage would risk constraining the very heterogeneity of definitions that the review seeks to capture, potentially excluding relevant studies that conceptualize these outcomes differently. For this reason, we have retained our planned approach of mapping definitions across the included studies. We recognize the value of standardization, and we will draw on the resulting mapping to propose operational definitions and a categorization framework as part of the final systematic review.

Conceptual framework, structured GRADE assessment, data extraction form, handling of missing data, and reviewer calibration.

As these refinements pertain primarily to the synthesis and reporting of results rather than to the scientific validity of the protocol itself, we will incorporate them at the appropriate stage of the final systematic review — including a conceptual model linking intervention types, mechanisms, and outcomes; a more structured, GRADE-informed narrative appraisal of certainty per outcome; and fuller documentation of the data extraction form, the handling of missing or unclear data, and the inter-reviewer calibration exercise. We will keep these points in mind throughout the conduct of the review.

We thank you again for your feedback, which has strengthened the protocol.

Competing Interests: No competing interests were disclosed.