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Quality, safety and performance indicators in primary care: a
systematic review of barriers, facilitators and the conditions shaping
their sustained use.

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Abstract

Background: Strengthening Primary Health Care (PHC) is a global policy priority, and
measurement is increasingly positioned as a strategic lever for learning, quality improvement
and reform. Yet the use of indicators and performance data for learning in primary care
settings remains inconsistent, and what enables data to translate into improvement is poorly
understood.

Aim: To synthesise empirical evidence on how quality, safety and performance indicators are implemented and used in primary care, and to identify the barriers and facilitators shaping their sustained use.

Methods: MEDLINE, EMBASE, and Scopus were searched from 1 January 2014 to 4 June 2025. Empirical studies from high-income countries examining the use or implementation of quality, safety, or performance indicators in primary care were eligible. Data were analysed using descriptive synthesis and inductive thematic analysis of barriers and facilitators across studies. Reporting followed PRISMA guidelines.

Results: Twenty-six studies from nine countries were included: United States (n=6, 23%), United Kingdom (n=6, 23%), Canada (n=4, 15%), Netherlands (n=3, 12%), Australia (n=2, 8%), Japan (n=2, 8%), and Belgium, Germany and Sweden (n=1 each, 4%). Study designs included mixed methods (n=13, 50%), qualitative (n=12, 46%) and quantitative (n=1, 4%). Six interdependent themes shaped indicator use: clinical relevance and improvement value (23 of 26 studies); alignment with practice priorities and improvement goals (25 of 26); alignment with policies, financial incentives and system partners (15 of 26); digital and data enablement for improvement (24 of 26); practice infrastructure and adaptive capacity (13 of 26); and leadership and continuous learning culture (22 of 26). Successful use of indicators also required convergence across three meta-conditions: value, fit and alignment, supported by organisational enablers and by meso-level actors whose bridging and brokering work activated these conditions.

Conclusion: Indicator-based improvement in primary care gained traction not through the indicators themselves, but when value, fit and alignment converged across clinical practice and the wider system, brokered into place by the actors who worked between them. Strengthening these mutually reinforcing conditions, rather than addressing isolated barriers,

offers a more realistic path towards effectively embedding and sustaining indicator use and advancing primary care as a Learning Health System.

Keywords: Primary health care; Quality indicators, Health care; Quality improvement; Implementation science; Barriers and facilitators; Practice facilitation; Learning health system; Systematic review

Background and Rationale

Strengthening Primary Health Care (PHC) remains a global policy priority, essential for achieving universal health coverage and the health-related Sustainable Development Goals (1,2). Patient-facing PHC services act as the core integrative hub of the broader health system, coordinating care pathways and linking individual clinical needs with population-level health initiatives (3). High-performing PHC is defined across several landmark frameworks. Starfield's canonical functions emphasise first-contact access, continuity, comprehensiveness and coordination (4,5). The Institute of Medicine extends these pillars to encompass safe, effective, patient-centred, timely, efficient and equitable care (6,7). The World Health Organisation (WHO) positions monitoring, evaluation, research and quality improvement as strategic bridges to achieve these outcomes (8) and has contributed to internationally recognised measurement frameworks (9,10). Within this agenda, measurement systems must do more than report and monitor performance; they must actively support decision-making, learning and improvement at the frontlines of care (9). Models of high-performing primary care, and the measurement frameworks that support them, position this capacity for data-informed improvement as a foundational capability (9,11). However, even as policy aspirations have held steady and measurement frameworks have matured, this foundational capability is unevenly realised: the use of indicators and performance data for

learning and improvement in frontline care remains inconsistent, and what enables data to be translated into improvement is poorly understood (12,13). This gap matters because measurement alone does not improve care; its value depends on whether performance data are trusted, interpreted, and acted upon within routine clinical and organisational work (14,15). Understanding what enables this capacity in practice is therefore a central task in realising the goals of primary care reform.

Indicator-based improvement initiatives are a practical mechanism through which data-informed improvement is organised and enacted in routine practice. How these initiatives are implemented and sustained in routine primary care is the focus of this review. The Learning Health System (LHS) model has gained traction as a strategic framework that extends the idea of using routine data to build large-scale improvement capability within and across system levels (16–19). First described by the Institute of Medicine in 2007, the LHS emphasises transforming healthcare activities into actionable data, integrated with research and stakeholder insights, and applied through continuous cycles of data capture, analysis and feedback (20). Yet, despite rapid growth in the empiric LHS literature (19,21–23), evidence that routine data reliably function as learning mechanisms remains limited and is drawn largely from hospital and specialty settings (24) with such learning cycles still rarely examined in primary care (25,26).

The Quality Improvement (QI) literature, on which the LHS itself draws, offers a more granular, empirically-grounded lens for examining how data-informed improvement operates in practice. Its methods map directly to the core transitions in the LHS learning cycle (17,18,27), translating clinical performance into structured data, converting that data into actionable insights and measuring the impact of changes undertaken (28). Building on a long tradition of systematic measurement and iterative learning in healthcare (29–33), these principles have been operationalised through structured such as Continuous Quality

97 Improvement (CQI) (28), incorporating Audit and Feedback (A&F) (13) and Plan-Do-Study-
98 Act (PDSA) (34) cycles, methods that rely on measurement, feedback, learning and
99 adaptation as core mechanisms of change. By design, these cycles organise data, measures,
100 indicators and feedback mechanisms into structured arrangements that shape how
101 performance data are used to identify care gaps and generate insights for improvement (35–
102 37). In this review, such arrangements were collectively treated as indicator-based
103 improvement initiatives, with attention to how they were implemented and sustained as
104 integrated systems in routine primary care.

105 Research on these initiatives has examined their methods and tools in depth, with
106 effectiveness as the dominant focus. The effectiveness of CQI methods including audit and
107 feedback, practice facilitation, point-of-care reminders, and PDSA-based improvement cycles
108 is well established, with benefits most consistently described for clinical processes and
109 professional practice rather than clinical outcomes (38,39). Effectiveness alone, however,
110 does not ensure improvement in routine practice. As Irwin et al. (2015) observe, the success
111 of these methods may depend as much on how they are implemented as on the strength of
112 their evidence base. Previous reviews of primary care indicators have examined how
113 indicator sets have been selected (40), which indicators have been deployed in practice (41),
114 and how their methodological quality has been assessed (37). Where implementation of these
115 tools has been studied, however, it has largely been at the level of the delivery modality.

116 Reviews of interactive dashboards and clinical decision support systems have examined
117 determinants such as usability, workflow integration and clinician trust in the underlying data
118 (42,43). Such work describes how the vehicle for feedback is adopted, rather than how the
119 indicators themselves are selected, interpreted, and acted upon within routine clinical and
120 organisational work. With the exception of a study conducted by Addington et al. (2010), the
121 barriers and facilitators to indicator use itself have attracted little attention, and the conditions

that enable indicators to be used for learning and improvement in routine primary care remain poorly understood (44). This review therefore examined empirically derived barriers and facilitators shaping the implementation and use of indicators in real-world primary care settings. The current review aims to synthesise empirical evidence on how quality, safety, and performance indicators are adopted, integrated into routine practice, and sustained in primary care as mechanisms for data-driven learning and improvement. First, we asked (Research Question (RQ) 1): how have the implementation and evaluation of these indicators in primary care been studied? Then, we asked (RQ2): what barriers and facilitators shape the adoption, integration, and sustained use for learning and improvement?

Methods

The protocol for this systematic review was prospectively registered with PROSPERO (CRD42024611637) and the review reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (45). The completed PRISMA 2020 checklist is provided in Additional file 1.

Search strategy

Three academic databases (MEDLINE, Scopus and EMBASE) were searched for English language studies published between 1 January 2014 and 4 June 2025, using the keywords related to primary care, quality, safety and performance indicators, and the factors influencing their use (Additional file 2). The 2014 start date was set to capture the most recent decade of literature. The initial search was conducted on 21 March 2024, and an updated search was conducted on 4 June 2025.

Inclusion criteria

For this review, primary care refers to patient-facing services, practice teams and support roles, and the terms general practice, family practice and family medicine are used interchangeably across included studies. Studies were included if they were: (1) conducted in primary care settings, such as general practice, community physiotherapy or similar first-contact services; (2) set in Organisation for Economic Co-operation and Development (OECD) high-income countries as defined by the World Bank (46); (3) employed empirical methods, including qualitative, quantitative or mixed methods designs; (4) were published as full-text, peer-reviewed journal articles; (5) investigated the implementation or evaluation of indicators; and (6) reported barriers and/or facilitators influencing implementation outcomes. Studies focused on palliative care, long term care/residential care, or rural emergency units were excluded.

Screening and data extraction

Records were managed in Zotero (Corporation for Digital Scholarship), de-duplicated in Covidence, and screened in Rayyan (Qatar Computing Research Institute). Six reviewers screened titles and abstracts independently in pairs (GF/SSp, SSh/MS, BF/EH), with each pair screening one-third of records. Backward (reference-list) and forward (citation) searching of key papers identified during screening was undertaken to identify additional eligible records. Disagreements between pairs were resolved through discussion with a third reviewer. Full-text screening was conducted according to the same process. Eligible full texts were exported in Excel format and records for extraction allocated among the team within the Excel file. A customised REDCap extraction tool was developed and piloted by five reviewers (BF, GF, SSp, SSh, MS). Extracted data included study characteristics (author, year, country, setting, design), research aims, key aims of improvement initiatives, selected indicators, and reported barriers and facilitators. Four reviewers extracted data independently

(GF, SSp, SSh, MS); one reviewer (BF) checked all records for completeness and accuracy. Discrepancies were discussed and resolved in team meetings.

Quality assessment

Study quality was assessed using the Mixed Methods Appraisal Tool (MMAT), enabling a consistent approach across the diverse study designs included in this review. Studies with scores below three out of five MMAT quality criteria were excluded (47). Four reviewers (GF, MS, SSp, SSh) completed initial quality assessments, and all studies were reviewed by a fifth reviewer (BF). Decisions were finalised through discussion and consensus between two reviewers (BF, GF).

Data analysis

To address RQ 1 a descriptive synthesis was conducted to classify studies by setting, study aims, empirical methods, improvement aims and the indicators implemented. To address RQ 2, an inductive thematic analysis was conducted to examine reported barriers and facilitators. Two reviewers (BF, GF) independently coded extracted data, progressing from descriptive coding to pattern identification and reflexive interpretation following Braun and Clarke's established approach (48,49). Coding outputs were reviewed iteratively with the wider research team to support rigor and consensus. Initial analysis revealed that many implementation factors functioned as both barriers and facilitators depending on local context. These were therefore examined together as contextual influences. Once themes were established, all data were re-examined to identify overlapping codes and ensure the final structure reflected coherent patterns and interdependencies. The first author (BF) is a GP and practice-based researcher with experience in LHS implementation. The second author (GF) is a Physiotherapist and researcher with experience in implementation science research. This positionality informed a reflexive approach to thematic analysis.

Results

The initial search across three electronic databases returned 4,501 references. After removal of 1,442 duplicates, 3,059 records were screened by title and abstract (Figure 1). Of these, 2,908 were excluded, leaving 151 full-text articles for review. Following full-text screening, 130 articles did not meet eligibility criteria. Backwards and forwards citation searching of the remaining 21 studies identified seven additional articles, resulting in 28 articles for quality appraisal. After methodological quality appraisal using the MMAT, two studies were excluded due to scores below 3, resulting in 26 studies included in the final synthesis.

<<Insert updated PRISMA flow diagram here>>

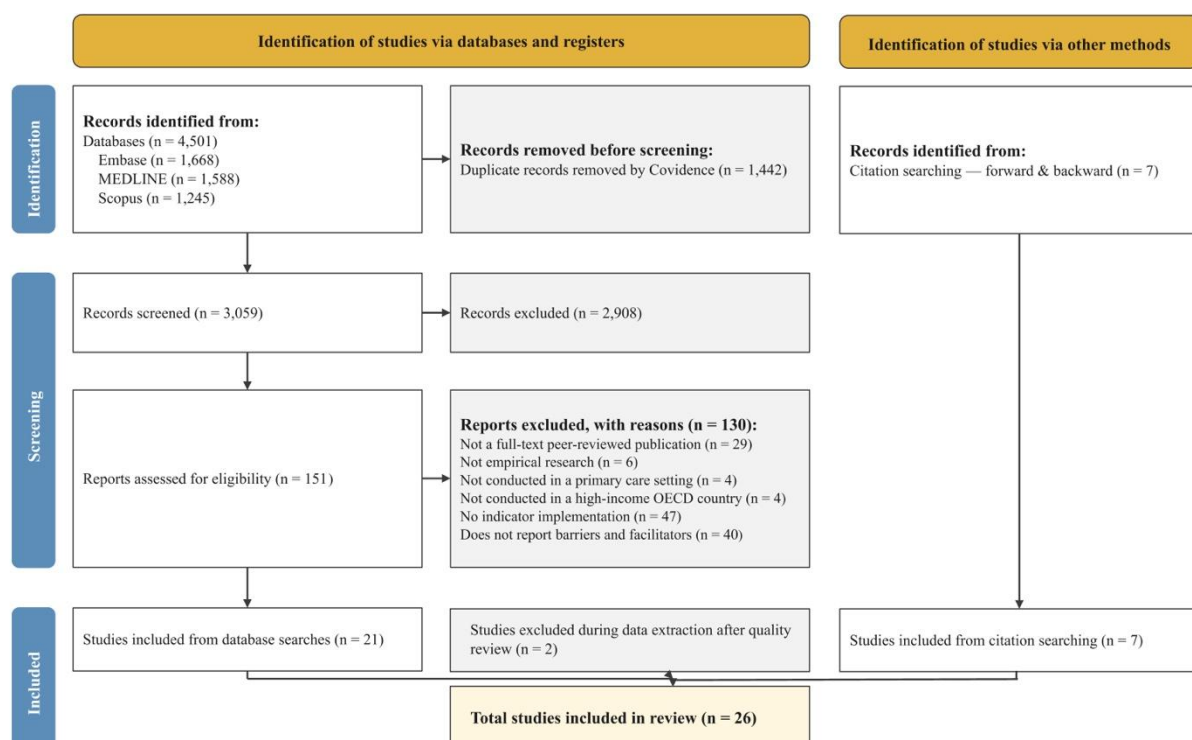


Figure 1. PRISMA flow diagram of study selection

Research Question 1: How have the implementation and/or evaluation of quality, safety, or performance indicators in primary care been studied?

Study characteristics

206 Twenty-six studies were included from nine countries: United States (n=6, 23%), United
 207 Kingdom (n=6, 23%), Canada (n=4, 15%), Netherlands (n=3, 12%), Australia (n=2, 8%),
 208 Japan (n=2, 8%), and Belgium, Germany and Sweden (n=1 each, 4% each). Settings included
 209 general practice/family practice (n=14, 54%), enhanced primary care models with
 210 multidisciplinary teams (n=7, 27%), allied health practice (n=2, 8%), pharmacy (n=2, 8%),
 211 and community nursing (n=1, 4%). Study designs comprised mixed methods (n=13, 50%),
 212 qualitative (n=12, 46%), and quantitative (n=1, 4%). Table 1 provides an overview of study
 213 characteristics.

214 ***Table 1. Summary characteristics of included studies***

First Author	Setting	Clinical Focus	Indicators (number)	Study Aim	Study Design
Australia (N=2/26, 7.7%)					
Hespe et al. (50)	General Practice/ Family Practice	Cardiovascular disease assessment and management	Proportion of regular patients receiving guideline-recommended cardiovascular disease risk assessment and management (*)	To assess the impact of a Quality Improvement Collaborative and identify factors influencing implementation and adoption.	Mixed Methods
Manandi et al. (51)	General Practice/ Family Practice	Cardiovascular disease assessment and management	Measures linked to PDSA targets (Electronic Health Records optimisation, prescribing, cardiovascular disease risk-factor control) (-)	To assess Plan-Do-Study-Act (PDSA) cycle completion, quality, and barriers and enablers associated with use.	Mixed Methods
Belgium (N=1/26, 3.8%)					
Colliers et al. (52)	General Practice/ Family Practice	Antibiotic prescribing for respiratory infections	Validated prescribing indicators across six clinical indications (12)	To evaluate whether participatory action research improved prescribing and to share local lessons with peer practices.	Mixed Methods
Canada (N=4/26, 15.4%)					
Desveaux et al. (53)	Enhanced Primary Care Practice	Annual Quality Improvement planning	Access, continuity, prescribing, prevention, chronic disease management (25)	To explore physician engagement with Audit and Feedback and intention-to-action gaps.	Qualitative
Kiran et al. (54)	Enhanced Primary Care Practice	Prevention, diabetes care, patient experience, safe prescribing	Multiple measures of patient experience, continuity, diabetes, cancer screening, and high-risk prescribing. (-)	To evaluate a peer coaching program supporting the use of clinical performance data.	Qualitative

Rouleau et al. (55)	General Practice/ Family Practice	Safe prescribing, screening, diabetes	Cancer screening, immunisation, diabetes care (–)	To evaluate implementation of voluntary Audit and Feedback in team-based care.	Qualitative
Wagner et al. (56)	Enhanced Primary Care Practice	Quality improvement through Audit and Feedback	Selected measures reflecting patient-centred care, access, guideline-concordant practice, and population health priorities (11)	To evaluate the implementation of a voluntary, external Audit and Feedback intervention in a team-based primary care context.	Qualitative
Germany (N=1/26, 3.8%)					
Poß-Doering et al. (57)	General Practice/ Family Practice	Practice-level crisis resilience	Indicators across individual resilience, crisis prevention, organisational resilience, and climate resilience (32)	To develop, test and evaluate quality indicators and an Audit and Feedback program to support crisis preparedness in primary care.	Mixed Methods
Japan (N=2/26, 7.7%)					
Fujita et al. (58)	Pharmacy	Medication management for older adults	A set of indicators for high-quality home medication management (45)	To develop and assess measurement properties of quality indicators for pharmacist home-visit services.	Mixed Methods
Sato et al. (59)	Pharmacy	Medication safety in older adults	A set of validated indicators for geriatric pharmacotherapy (121)	To assess measurement properties of validated indicators in primary care.	Mixed Methods
Netherlands (N=3/26, 11.5%)					
Arslan et al. (60)	General Practice/ Family Practice	Formulary concordant prescribing	Prescribing indicators, including chronic obstructive pulmonary disease and asthma prescribing measures (3)	To evaluate benefits and challenges of a national pay for performance scheme based on routine data.	Qualitative
Maas et al. (61)	Allied Health Practice	Client centred, effective, and transparent physiotherapy care	Assessment framework across three domains: client centredness, effectiveness, transparency (–)	To evaluate feasibility of a quality improvement program in physiotherapy.	Mixed Methods
Schulte et al. (62)	Allied Health Practice	Physiotherapy quality and performance	Indicators of care process, practice management, and patient experience (23)	To assess motivation, adoption, and barriers and facilitators to using feedback reports.	Mixed Methods
Sweden (N=1/26, 3.8%)					
Anell et al. (63)	Enhanced Primary Care Practice	Care delivery and outcomes across acute, chronic, mental health, rehabilitation, and core domains	Eight reported indicators from a library of more than one hundred fifty (8)	To explore use of a data visualisation tool and associations with performance change.	Quantitative
United Kingdom (N=6/26, 23.1%)					

Grant et al. (64)	General Practice/Family Practice	High-risk prescribing	High-risk prescribing indicators (–)	To explore practice responses to a data-driven quality improvement program and sustainment.	Mixed Methods
Jeffries et al. (65)	Enhanced Primary Care Practice	Potentially hazardous prescribing	Thirteen prescribing and monitoring safety indicators (13)	To explore implementation and embedding of a rapid learning health system for medication safety.	Qualitative
Litchfield et al. (66)	General Practice/Family Practice	Whole of practice safety	Safety toolkit indicators across four domains (patients at risk, safety systems, culture, patient perspectives) (–)	To examine factors influencing adoption of a multi-component safety toolkit.	Qualitative
McCance et al. (67)	Community Nursing	Person centred care	Key performance indicators for nursing-specific person-centred practice (–)	To explore feasibility and utility of implementing person-centred nursing indicators.	Qualitative
Shamsuddin et al. (68)	General Practice/Family Practice	Prescribing safety	Prescribing safety indicators (–)	To identify strategies for implementation and sustainment of prescribing safety interventions.	Qualitative
Tsang et al. (69)	Enhanced Primary Care Practice	Acute kidney injury minimisation	Acute kidney injury indicators (6)	To implement and evaluate an Audit and Feedback dashboard for Acute Kidney Injury safety.	Mixed Methods
United States of America (N=6/26, 23%)					
Hemler et al. (70)	General Practice/Family Practice	Cardiovascular disease prevention	Four measures of aspirin use, blood pressure control, cholesterol management, smoking cessation (4)	To examine the challenges that practice facilitators face in using Electronic Health Record data for Quality Improvement.	Qualitative
Kansagara et al. (71)	Enhanced Primary Care Practice	Performance monitoring	Measures mapped to continuity, engagement, satisfaction, access, coordination, and clinical improvement (–)	To describe staff experiences with performance metrics during implementation of the care model.	Qualitative
Parchman et al. (72)	General Practice/Family Practice	Cardiovascular disease risk reduction	Measures of aspirin prescribing blood pressure control, tobacco screening and cessation (–)	To assess association between Electronic Health Record capability, leadership support, IT skills and successful Clinical Quality Measure (CQM) reporting.	Mixed Methods
Payne & Hysong (73)	General Practice/Family Practice	Whole of practice quality and performance	Quality and performance measures (>90)	To identify factors influencing acceptance and impact of clinical performance feedback.	Qualitative
Richardson et al. (74)	General Practice/Family Practice	Cardiovascular disease related patient outcomes	Measures of aspirin prescribing blood pressure control, tobacco screening and cessation (–)	To identify strategies to support future initiatives generating and reporting electronic Clinical Quality Measure (CQM) using Electronic Health Records.	Qualitative
Yakovchenko et al. (75)	Enhanced Primary Care Practice	Hepatitis C Virus (HCV) screening	Measures capturing untested eligible patients, patient choice, and new diagnoses (3)	To design, implement and evaluate a Lean facilitation intervention in community clinics.	Mixed Methods
Key: Study Setting Classifications			Indicator Notation		

General Practice/Family Practice: Primary care practices with medical practitioners only (for example GPs, practice nurses, nurse practitioners). **(number):** Number of indicators explicitly reported
(-): Number of indicators not specified
(*): Indicators co-designed with participating practices

Enhanced Primary Care Practice: Multidisciplinary, team-based primary care models incorporating allied health providers or academic partnerships.

Allied Health Practice: Studies conducted exclusively within allied health disciplines such as physiotherapy and occupational therapy.

Pharmacy: Studies conducted exclusively in pharmacy settings.

<< *Insert Table 1 about here* >>

Research Question 2: What barriers and facilitators shape the adoption, integration, and sustained use of these indicators for learning and improvement in primary care?

Thematic analysis

Six themes were identified: (1) clinical relevance and improvement value (n= 23/26, 88.5%); (2) alignment with practice priorities and improvement goals (n= 25/26, 96.2%); (3) alignment with policies, financial incentives and system partners (n= 15/26, 57.7%); (4) digital and data enablement for improvement (n= 24/26, 92.3%); (5) practice infrastructure and adaptive capacity (n= 13/26, 50.0%); and (6) leadership and continuous learning culture (n= 22/26, 84.6%). Although analytically distinct, these themes operated as interdependent conditions shaping indicator adoption, integration, and sustained use. Implementation was rarely supported by a single facilitator; rather, it depended on the convergence of multiple reinforcing factors. A descriptive summary of themes and illustrative quotes is provided in Table 2.

Table 2. Key themes and sub-themes

Theme/Subtheme	Summary finding	Illustrative finding	Author
1.0 Clinical relevance and improvement value (N= 23/26, 88.5%)			
<i>Clinicians engaged with indicators they judged clinically relevant, interpretable, and representative of care worth improving.</i>			
1.1 Point-of-care relevance and actionability	Reporting that was timely, specific, and usable at the point of care supported engagement; aggregated or delayed data limited usefulness.	F: <i>The indicators perceived to be the most meaningful, specific and better equipped to signal changes, making them easier for GPs to interpret and control.</i> – (Study derived finding) B: "Today the persons in mental distress, they're having problems. I'm not gonna ask	Arslan et al. (60) Kansagara et al. (71)

		them about their cholesterol and their colonoscopy? It's just not appropriate or relevant." – PCP	
1.2 Meaningful representation of primary care practice	Indicators that reflected meaningful, relational, and longitudinal aspects of primary care supported engagement; measures that reduced care to narrow tasks or outcomes outside clinicians' control did not.	F: "It is about the quality of the time you spend with the client and whether the story and survey match." – FG1 HV3 B: "It doesn't capture what you're trying to do as a provider. It only captures what the patient decides to follow through on." – ID06	McCance et al. (67) Desveaux et al. (53)
2.0 Alignment with practice priorities and improvement goals (N= 25/26, 96.2%) <i>Initiatives gained traction when they aligned with and complemented existing improvement work and fit routine care delivery.</i>			
2.1 Compatibility with existing improvement activities	Initiatives aligned with existing improvement work were adopted; duplication or conflicting requirements reduced engagement.	F: "The intervention was seen as a tool that could develop learning and lead to changes in work practices and the quality and safety of patient care" – Pharmacist P3 B: "Because monthly QI data submission competes with our monthly reimbursement submission, we could not undertake QI data extraction until we submitted the claim." – F2	Jeffries et al. (65) Fujita et al. (58)
2.2 Negotiating service delivery priorities	Competing clinical demands and limited protected time constrained engagement in data-informed improvement.	F: "We've worked on the workflow for that. Every practice has embraced it fully and adapted the cholesterol measure into their own systems." – Facilitator, Cooperative 6 B: "GPs reviewed patients once routine work was finished. We ended up doing it at half past six, seven o'clock in the evening" – GP 2	Hemler et al. (70) Grant et al. (64)
3.0 Alignment with policies, financial incentives and system partners (N= 15/26, 57.7%) <i>Indicator-based initiatives were adopted and sustained when aligned across policy, system partner, practice, and clinician priorities.</i>			
3.1 Alignment with policies and system partners	Alignment with policy priorities and system partners supported sustainability; fragmented systems hindered implementation.	F: "The support of local healthcare organisations was seen as essential, alongside national funding, to ensure sufficient engagement and maintenance over time." – (Study derived finding) B: <i>Fragmentation of the EHR supplier market and lack of uniformity between EHR systems was a challenge for using routine healthcare data from general practices in the P4P scheme.</i> – (Study derived finding)	Shamsuddin et al. (68) Arslan et al. (60)
3.2 Alignment with funding, incentives and resourcing	Incentives and resourcing enabled participation; competing financial priorities reduced focus on data-informed improvement.	F: "The GP that picked up on it as another income stream. We're running a business, so we've got to be doing things that are financially rewarding." – Practice Manager WM04 B: <i>All users described how the competing priorities of acute care and other financially rewarded performance targets took precedence over formative safety work.</i> – (Study derived finding)	Litchfield et al. (66) Tsang et al. (69)
4.0 Digital and data enablement for improvement (N= 24/26, 92.3%) <i>Indicator use depended on whether practices could trust data, access usable reports, integrate tools into workflow, interpret findings, and act on them within routine systems.</i>			
4.1 Data quality, trust and governance	Trusted and accurate data supported engagement; perceived inaccuracy, incomplete data and governance concerns led to distrust and non-use.	F: <i>Validating measures was a necessary step to ensure measure accuracy, build trust in the data.</i> – (Study derived finding)	Hemler et al. (70)

		B: “The general opinion in our practice was that the data was not reliable – we did not use the results.” – Physiotherapist 1	Scholte et al. (62)
4.2 Data access, extraction and reporting	Automated extraction, timely reporting and accessible representations enabled consistent indicator use; manual processing, delayed access and cumbersome reporting systems increased burden and reduced engagement.	F: <i>Advanced EHR reporting capability was the only domain associated with reporting 2 or more CQMs.</i> – (Study derived finding) B: “From a clinical point of view, it’s just a bit too cumbersome and time-consuming to be useful and I don’t think we’re going to continue using it in our practice.” – GP Registrar GM03	Parchman et al. (72) Litchfield et al. (66)
4.3 Integration and workflow customisation	Indicators embedded within existing systems and aligned with workflows supported use; poorly integrated tools, fragmented systems and disruptive alerts reduced uptake and were often ignored.	F: <i>Co-developed pop-up notifications integrated into the EHR system had a pronounced impact on prescribing behaviour and were adopted by another practice.</i> – (Study derived finding) B: “There was disconnect between the whole report...no way to export it, a lot of links that didn’t connect well, creating lots of work afterwards.” – ID005	Colliers et al. (52) Wagner et al. (56)
4.4 QI Facilitation, training and interpretive support	Training, facilitation, and interdisciplinary support enabled teams to interpret reports and translate indicators into practice change; without it, data were received passively rather than acted upon.	F: “Their kind of validation of my perception of my patient population and then practical like problem-solving, yeah, it made me feel less overwhelmed.” – Coachee 2303 B: “Until you start giving monthly reports with targeted topics and actually educating the GPs about what to do with that data, you’re just extracting data.” – PHN1	Kiran et al. (54) Hespe et al. (50)
4.5 Technical adaptation and health-IT support	Accessible technical support and health-IT facilitation enabled teams to troubleshoot system issues and adapt digital infrastructure; absent or delayed support resulted in breakdowns, workarounds and abandonment.	F: <i>Facilitators helped practices negotiate with health systems, EHR vendors, or external data providers.</i> – (Study derived finding) B: <i>For software-based tools, it became clear that limited familiarity with the clinical system and a lack of information technology training limited staff ability to use some of the tools.</i> – (Study derived finding)	Hemler et al. (70) Litchfield et al. (66)
5.0 Practice infrastructure and adaptive capacity (N= 13/26, 50.0%) <i>Sustained indicator use depended on the structural and operational conditions within each practice.</i>			
5.1 Operational capacity to support indicator-based improvement work	Dedicated time, staffing, and resources enabled indicator use; limited capacity constrained engagement and sustainability.	F: “It all comes back to the fundamental crux – if you had more time, people, and money, I think you could proactively look after this whole group of at-risk patients.” – P8 pharmacist B: “They’re dictating new measures or reports...without ensuring that the structure is solid. You don’t even have the staff to put it into place.” – PCP	Tsang et al. (69) Kansagara et al. (71)
5.2 Team-based infrastructure and coordination	Team-based structures and communication supported coordinated improvement; siloed work limited it.	F: “It took a while but hearing each other and dealing with barriers as a group - we would never have gotten there if we didn’t put together an infrastructure.” – (Participant quote)	Richardson et al. (74)

		B: No regular 'team' meetings or systems in place to report back on QI measures and limited ability to organise tailored educational activities. – (Study derived finding)	Hespe et al. (50)
6.0 Leadership and continuous learning culture (N= 22/26, 84.6%)			
<i>Leadership behaviours and learning-oriented cultures shaped whether teams engaged meaningfully with indicator use.</i>			
6.1 Distributed and collaborative leadership	Shared leadership supported ownership and engagement; top-down approaches reduced engagement and adoption.	F: Organizational leadership view QI projects as an opportunity to obtain technical assistance for practice transformation, improved data capability and reporting. Leadership makes resources available to remove barriers to data use for care improvement. – (Study derived finding) B: Staff were often frustrated by what they perceived as a “top-down” approach to performance metric implementation. This dictated approach took away from their own sense of agency as care providers. – (Study derived finding)	Parchman et al. (72) Kansagara et al. (71)
6.2 Supportive, learning-oriented feedback culture	Constructive, non-punitive feedback supported learning; judgemental feedback discouraged engagement.	F: “He’s collegial, open-minded and non-judgemental which actually means a lot to me...somebody who you trust.” – (Coachee 2302) B: Physicians can become irritated, resentful and apathetic when they feel they are penalized for factors beyond their control or when feedback is delivered in a derogatory manner. – (Study derived finding)	Kiran et al. (54) Payne & Hysong (73)

<< Insert Table 2 about here >>

Theme 1. Clinical relevance and improvement value (N=23/26, 88.5%)

1.1 Point-of-care relevance and actionability. Clinicians were more likely to use indicators when patient-level data identified care gaps, signalled clear actions, accommodated patient-specific risk factors and warranted variation, and were available in time to inform decisions within the consultation (50,55,58–60,62,64,65,73,75). Aggregated practice-level data were less actionable, as clinicians consistently struggled to connect summary reports to individual patients or specific clinical decisions that would generate improvement (53,55,56,58–60,62,63,73).

1.2 Meaningful representation of primary care practice. Many clinicians questioned whether indicator systems adequately captured the relational, generalist and longitudinal nature of high-performing primary care (53,61,67), describing a tension between the summative nature of practice-level feedback and the patient-centred realities of day-to-day

clinical work (53,54,59,60,71,73). Clinicians critically appraised indicator selection and were reluctant to engage with initiatives they believed would misrepresent their clinical performance, citing concerns about unrepresentative denominators, case mix bias, and clinical activity that was delivered but not captured in routine data (53,54,56,58–60,71,73). Clinicians also questioned outcome measures used as proxies for individual performance and binary measures of guideline concordance, which they argued conflated care delivered with patient choices (50,51,53,55,71,73) and failed to distinguish sound clinical judgement from a deficit in care (58–60,64).

Theme 2. Alignment with practice priorities and improvement goals (N=25/26, 96.2%)

2.1 Compatibility with existing improvement activities. Practices already engaged in quality improvement work more readily adopted initiatives that strengthened existing processes, provided clearer reporting, or structured improvement efforts around meaningful local goals (52,64,65,68,70,74). In contrast, duplication and conflicting program requirements reduced engagement. Where initiatives overlapped with accreditation, billing or compliance reporting, indicator-based activities were experienced as repetitive rather than additive (56–58,66,74). As one participant explained, "You can't win, you're given two directives that just bounce off each other, you can't make that fit" (71). Some indicators were also viewed as poorly aligned with improvement goals because they were too broad, lacked local relevance, or were disconnected from local priorities (50,53,59,60,62).

2.2 Negotiating service delivery priorities. Balancing formative improvement work with acute clinical care was challenging even for highly motivated teams (50,51,54,64,69,73). Improvement tasks were frequently deferred or completed after hours when they could not be accommodated within routine workflows (50,53,64). Data extraction, review and PDSA activities were often perceived as extra work, and engagement declined when the burden was

not offset by perceived benefit (50,55,59,65,67,73). Practices that successfully integrated indicator-based improvement were commonly supported by embedded roles or external facilitation that assisted with data management and coordination (47,52–54).

Theme 3. Alignment with policies, financial incentives and system partners (N=15/26, 57.7%)

3.1 Alignment with policies and system partners. Several studies highlighted the importance of aligning initiatives across practice, regional, and system levels, with local organisational support, alignment with policy priorities, and national funding mechanisms identified as necessary conditions for sustainability (56,65,66,68,74). In contrast, fragmented Information Technology (IT) systems, data governance arrangements, and poor communication across system partners undermined local improvement efforts (60,68,70,72,74). Where initiatives were successful, this was often attributed to middle-level actors including regional coordinators, GP academics, data experts, and learning facilitators who brokered solutions and created coherence between system levels by negotiating solutions with software vendors, supporting data linkage across primary and secondary care and forming interdisciplinary data teams (52,56,60,65,66,68,72,74).

3.2 Alignment with funding, incentives and resourcing. Financial pressures shaped whether practices could sustain indicator-based activities alongside core practice functions. Even where clinicians valued indicator use, participation depended on whether activities were financially viable within the existing service model (50,58,61,66,69,73). Where provided, financial incentives acted less as motivators than as mechanisms that enabled participation without requiring practices to sacrifice billable clinical time (50,61,64,73). This was achieved through external funding that converted improvement work from after-hours activity into paid working time (52), and through dedicated resourcing of the roles and functions needed to

manage data, coordinate improvement responses, and absorb implementation workload (56,70,72,74). As one participant explained, "This financial support makes the difference between having to work for free after hours or actually during working hours." (52).

Theme 4. Digital and data enablement for improvement (N=24/26, 92.3%)

4.1 Data quality, trust and governance. Clinicians were more likely to use indicators when they recognised them as valid representations of practice, could participate in verifying their accuracy, and could use them as trusted evidence in professional decision-making (60,61,69,70,74). By contrast, clinicians questioned indicator use when data were inaccurate, incomplete, outdated, or did not reflect clinical practice (52–54,56,60–62,69,70,74,75). Trust also declined when multiple intermediaries were involved in data handling, when coding systems were inconsistent, or when poor documentation reduced confidence in how measures had been generated (52,56,60,62,69,70).

4.2 Data access, extraction and reporting. Indicator use was more consistent when automated extraction, timely reporting, and accessible representations reduced manual burden and improved access to actionable information (60,63,65,72). In one mixed-methods study, advanced EHR reporting capability was demonstrated to be strongly associated with the ability to report multiple quality measures (72). By contrast, manual extraction, repeated searching, delayed reporting, and cumbersome audit processes made participation difficult to sustain and were often described as too labour intensive to justify continued use (50,55,56,58,66,74).

4.3 Integration and workflow customisation. Digital tools functioned as facilitators or barriers depending on how well they fit within existing information systems and routine workflows. Clinical decision-making and risk stratification tools that fit naturally into consultations were more likely to be adopted (50,52,65,68,69,74). By contrast, poor

interoperability, poorly timed pop-ups, and poorly integrated reporting platforms described as “clunky”, “slow”, or “difficult to interpret” were perceived as disrupting workflow and reducing practical value (50,56,60,61,64,66,68,74). These issues frequently led to indicator systems being ignored or abandoned.

4.4 QI Facilitation, Training and Interpretive Support. Across studies, training, facilitation and interdisciplinary collaboration supported data interpretation and use (50–52,54,56,65,67,70,74). Practices without this resource described low data literacy and reduced engagement (50–52,54,56,65,67,70,74). By contrast, where training and support were absent, teams described passive data receipt rather than active quality improvement and uncertainty about what actions should follow reporting (50,55,56,66,71,72).

4.5 Technical adaptation and Health-IT support. Accessible technical support enabled practices to troubleshoot system barriers, adapt digital infrastructure and sustain indicator use over time (65,67,70,72,74). Skilled facilitators provided end-to-end support, including resolving technical problems, liaising with vendors, and helping practices understand what their EHR systems could do for quality improvement. One study highlighted the need to bridge “cultural differences between database people, EHR people and clinicians” through regular shared problem solving (74). Several participants reported that without this support, teams were more likely to abandon tools after minor technical failures particularly where staff lacked confidence using unfamiliar software or where system functionality was poorly understood (50,55,66).

Theme 5. Practice infrastructure and adaptive capacity (N=13/26, 50%)

5.1 Operational capacity to support measurement-based work. Practices were more likely to sustain indicator use when protected time, dedicated roles, and sufficient staffing supported measurement-based work (56,64,65,69). Two studies described technically trained

pharmacists working in hybrid clinician–informatics roles, supporting medication reviews and providing situated training that helped integrate digital tools into routine clinical workflows (65,68). In contrast, limited infrastructure, staffing, and preparation reduced the capacity to take up new indicator systems (50,56,58,64,66,69,71).

5.2 Team-based infrastructure and coordination. Practices were more likely to sustain improvement when regular meetings, shared accountability, and whole-team involvement supported coordinated action. Protected time for team discussion enabled clinicians and staff to review indicators collectively, share tasks, and develop new workflows, creating conditions for problem solving rather than isolated response (57,60,65,68,74). By contrast, where communication systems were inadequate and work remained siloed, improvement activities were fragmented and depended on the efforts of individuals (50,51,60,64,65).

Theme 6. Leadership and continuous learning culture (N=22/26, 84.6%)

6.1 Distributed and collaborative leadership. Sustained engagement was strongest where leaders modelled “professional norms and quality” (63), motivated colleagues, encouraged shared ownership of improvement work (52,61,68,69). Organisational leaders who provided technical assistance and made resources available for reporting and data use further supported engagement (52,63,67,72,75). Bottom-up approaches, where teams could adapt indicator use to local priorities, strengthened participation and ownership, whereas top-down implementation reduced agency and limited buy-in (63,71,75). Where initiatives were perceived as serving the interests of insurers, commissioners, or administrators rather than clinicians or patients, participants described suspicion about programme purpose, diminished motivation to invest effort, and a loss of trust in the measurement process itself (60–62,73). Where implementation was poorly communicated or indicator purpose was unclear, participants reported resistance and disengagement (50,52,56,75).

6.2 Supportive, learning oriented feedback. Across studies, supportive feedback and skilled facilitation enabled safe, constructive, and clinician-centred learning dialogues (52,54,57,61,62,67,73). High-quality feedback was characterised as clear, timely, learner centred, and strengths based, supporting reflection, benchmarking and shared problem solving (52,57,60–63,73). Feedback was more readily accepted when it was specific enough to guide action, delivered by trusted peers or facilitators, and framed as an opportunity for improvement rather than judgement (53,54,61,63,73). As one participant noted, “Even if the feedback wasn’t that positive, it still gave us the chance to fix things and brought us together around a shared purpose” (67). By contrast, feedback perceived as evaluative, judgemental or punitive provoked frustration, mistrust and disengagement (53,62,73). Where practices developed normalised cycles of review, shared learning routines, and a staff culture oriented toward continuous improvement, indicator use became embedded and self-sustaining (52,58,59,64,67,68,75). Where these conditions were absent, early engagement frequently did not translate into sustained improvement activity (50,53,55,61,63).

Three meta-conditions: value, fit and alignment.

When examined together, the six themes suggested that the successful use of indicators in routine primary care depended on three interrelated conditions: value, fit and alignment. These conditions were not independent. Each was supported or undermined by organisational enablers operating locally, including practice infrastructure, leadership and learning culture, which, in turn, amplified or constrained these three conditions. Across the studies, these organisational enablers were mobilised by meso-level actors, including regional coordinators, GP academics, data experts, and learning facilitators, who bridged the clinical frontline and the wider system, brokering resources and carrying learning across levels. This bridging and brokering function, of which facilitation is one expression, was rarely named as such in the source studies, but it recurred strongly across each theme. A further emerging finding

concerned how facilitating factors or barriers were configured rather than any single ingredient. When factors lined up across multiple themes, small cumulative cycles of learning and change emerged (64,65,68,70). The reverse pattern also occurred. When multiple barriers coincided initiatives generated burden, disengagement and abandonment, with corresponding erosion of motivation, efficiency, and trust (50,51,55,71,73).

<<<INSERT Figure 2 about here>>>

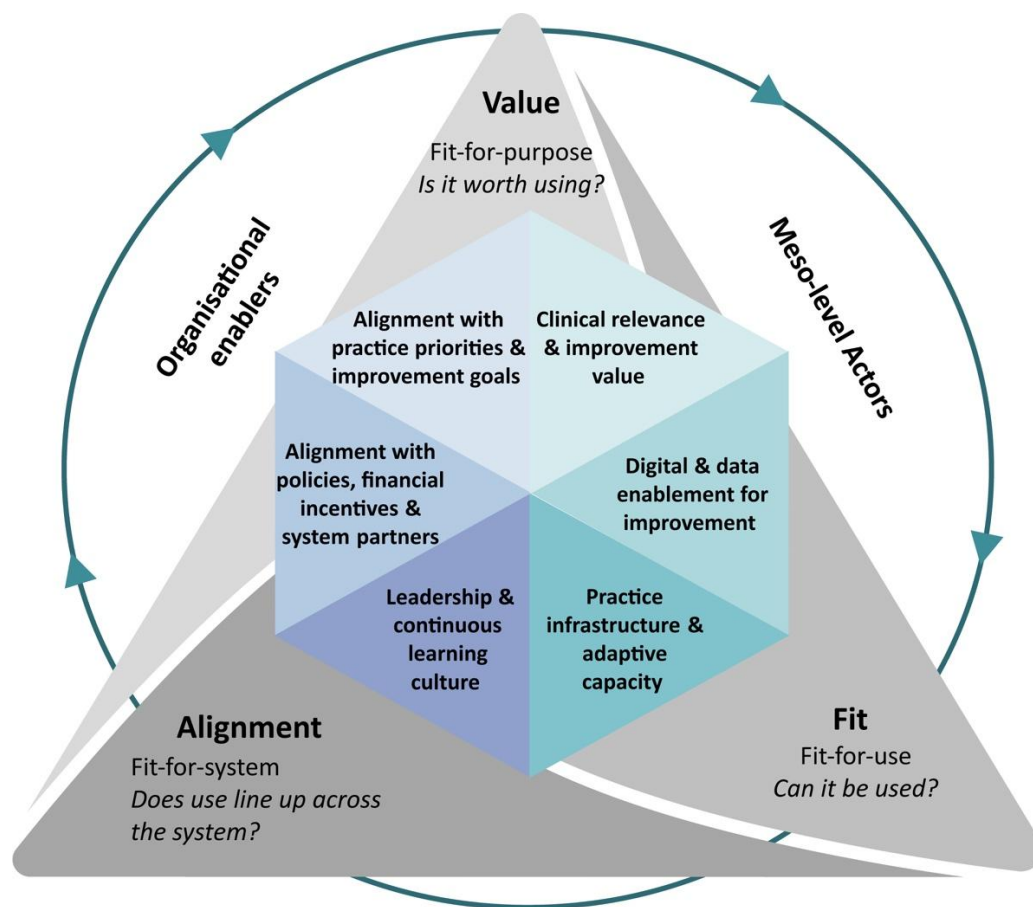


Figure 2: Conceptual model of implementation conditions for indicator-based improvement in primary care

Figure 2 presents a conceptual model of implementation conditions for indicator-based improvement in primary care. The six themes are organised at the centre of the three cross-cutting meta-conditions identified in this review (value, fit, and alignment). Organisational

enablers that were identified (infrastructure, leadership and learning culture operating at the practice level and regional scale) amplify or constrain these conditions and are themselves mobilised by meso-level actors whose bridging and brokering function operates across the themes, conditions and enablers.

Discussion

We synthesised empirical evidence on how indicators are implemented and used in routine primary care and identified barriers and facilitators influencing their use. Across twenty-six studies these determinants were identified almost exclusively through the qualitative research and the qualitative components of mixed methods studies. This suggests that the factors shaping indicator implementation are best understood through the experiences and perspectives of those using them in everyday practice, rather than through quantitative measures alone. Six interdependent themes were developed: clinical relevance and improvement value; alignment with practice priorities and improvement goals; alignment with policies, financial incentives and system partners; digital and data enablement for improvement; practice infrastructure and adaptive capacity; and leadership and continuous learning culture. Our findings address the identified gap in understanding how indicators are used for improvement in routine practice and what enables or constrains that use.

When examined together, the six themes revealed three cross-cutting, relational meta-conditions that consistently shaped implementation success or failure across study settings: value, fit and alignment (see figure 2). Indicator systems function as learning mechanisms in primary care only when they are valued by clinicians, fit operational workflows and are aligned across clinical practice and system-level structures. These conditions were shaped by organisational enablers operating locally, including practice infrastructure, leadership, and learning culture, which were, in turn, mobilised by meso-level actors who bridged the clinical

frontline and the wider system. Collectively, these meso-level actors and the work they did to build value, fit and alignment point to a bridging and brokering function that we examine in the sections that follow.

Three meta-conditions: value, fit and alignment

Value reflected whether indicator systems supported meaningful improvement and measured outcomes clinicians considered important; fit, whether they worked within the sociotechnical and workflow realities of routine practice; and alignment, whether priorities, incentives, and resources were coherent across system levels. Barbazza and colleagues propose that for performance indicators to be actionable they must be both fit-for-purpose and fit-for-use, with key considerations spanning methodological, managerial, and contextual domains across system levels (15). Our findings extend this to quality and safety indicators in primary care. Value corresponds to fit-for-purpose and fit corresponds to fit-for-use, with alignment as the cross-level condition through which shared purpose was mobilised into the collaboration, coordination and pooled resources that made indicator use workable. These conditions reinforced one another. Where they converged and were supported by adequate infrastructure and a learning culture, small generative cycles of learning and change became visible, with some practices restructuring workflows to protect improvement activity (64,65,68,70). These generative cycles represent early signs of implementation sustainability (76,77), suggesting that indicator use in primary care may become self-reinforcing when value, fit and alignment converge. Where these conditions were absent, the effects of barriers compounded, eroding motivation, efficiency and trust (50,51,55,71,73).

Value

While aligning improvement aims with professional motivation can generate support for improvement, converting that support into sustained engagement is not straightforward (78).

We found that it required indicators to deliver benefits that clinicians and practice teams could perceive in practice. These benefits were assessed across two dimensions: firstly, whether an indicator helped improve clinical care or organisational processes, and secondly whether it measured the care they considered worth improving. In the first instance, indicators were valued when they generated insight that was actionable at the point of service. For clinicians enacting clinical services, aggregate, practice-level indicators were only partially valued because they answered a system-level rather than patient-level question (53,55,60,73). Translating aggregated data into individual level use cases demanded interpretive effort that funding mechanisms rarely supported and that busy practices had little slack to absorb. In the second instance, indicators were valued when they measured care that clinicians recognised as worth improving. Clinicians assessed the improvement value of indicator systems against established standards of high-quality primary care (4,6), while also defending a relational, whole-patient conception of quality, consistent with established models of patient-centredness (79). The qualities they defended, particularly the relational and longitudinal nature of care, are themselves core functions of strong primary care (4), and carry measurable consequences. Pereira Gray and colleagues found that higher continuity of care is associated with significantly lower mortality and reduced hospital use across diverse health systems (80). This way of weighing value, against the benefit gained relative to opportunity costs rather than against compliance with targets, mirrors the logic at the heart of value-based healthcare (81). Indicators were valued when the improvement they enabled justified the effort they demanded and devalued when it did not.

Fit

While value determined whether clinicians judged an indicator worth using, fit determined whether clinicians were able to use the indicator effectively. An indicator was fit for use when

it worked within the consultation, the practice routines and the cognitive demands of a busy clinic. We found that fit was almost always mediated by technology, because indicators reached clinicians through electronic records, dashboards, prompts and extraction tools. Fit was therefore a sociotechnical achievement dependent on the interaction between human workflows and the systems through which indicators were delivered. The same digital innovation that closed the gap between data and decision making could equally disrupt workflow, generate cognitive burden and be abandoned where it fit poorly. These findings are consistent with evidence that digital health technologies in primary care are prone to non-adoption and failure to scale without sustained attention to usability, adaptability, and organisational support over time (82). Fit was most reliably sustained through adaptive implementation strategies, including embedded pharmacists supporting prescribing safety dashboards (65,68), health IT facilitators troubleshooting technical barriers (74), and QI facilitators addressing EHR data quality issues (70). These actors did the continuous sociotechnical work of keeping tools aligned with their intended use and supporting clinicians and practice teams to use them toward that purpose. This adaptive work, however, could not be generated by practices alone. It depended on resources, coherence, and shared purpose secured across system levels.

Alignment

While value asks whether an indicator is worth using and fit whether it can be used, alignment asks whether its purpose and the priorities of the wider system pull together or against one another. Across several studies, participants described indicator-based improvement initiatives whose goals pulled against the realities of use in practice. Measurement requirements conflicted with patient-centred care, competing projects crowded out existing improvement work or indicators failed to reflect what clinicians could influence

(50,53,55,58–60,62,71). Across these otherwise different tensions, the same problem recurred. In each case the purpose of the indicator and the priorities of practice were pulling apart, a misalignment that took both a relational and a structural form. The relational form was a breakdown of shared purpose among those involved, and the structural form was a lack of coherence between the strategies, resources and systems meant to support improvement. A recent review of alignment in the implementation of evidence-based interventions describes this same distinction (83). Lundmark and colleagues identify social alignment, the shared understanding and commitment of actors toward common objectives, and structural alignment, the coherence of strategies, resources and systems through which those objectives are pursued (83). Our findings specify how the two relate: social alignment was necessary but not sufficient. Shared purpose across practices, external partners, and policymakers could generate commitment (56,65,66,68,74), but it gained traction only when translated into structural arrangements, the coordination and dedicated roles that sustained improvement work (65,70,72,74). That translation did not happen on its own. It fell to actors working between levels.

Meso-level actors and the organisational work of bridging

Meso-level actors were central to bridging the translation gap, brokering agreement across levels and translating shared commitment into operational support. This bridging function was evident across all six themes. Across the themes, these actors performed a range of implementation functions, including practice facilitation that scaled local solutions across regions (52,56,60,65,66,68,72,74), to the in-situ troubleshooting of health IT experts (65,67,70,72,74), interdisciplinary collaboration to translate digitised data into action (50–52,54,56,65,67,70,74) and brokerage of the resources needed to address locally identified capacity constraints (56,70,72,74). Leading models of context and implementation each

capture elements of this function. Kaplan and colleagues' Model for Understanding Success in Quality (MUSIQ), and its later complex-systems reconceptualisation MUSIQ v2.0, emphasise the dynamic interactions between actors and a multi-level context in which improvement occurs (84,85). Aarons and colleagues, through use of the EPIS framework, describe bridging factors as the connective function linking inner and outer contexts through intermediary actors who broker relationships across system boundaries (86). Our synthesis joins these perspectives in the setting of primary care indicator use: the meso-level actors MUSIQ identifies were doing the bridging and brokering work that EPIS describes, and it was this work, rather than the presence of any single factor, that activated value, fit and alignment. Sustained indicator use depended not simply on indicator systems, but on the organisational work required to connect people, resources, technologies and priorities across levels of the system. Though rarely described explicitly as a meso-level bridging function, it was visible where indicator use was sustained and largely absent where initiatives stalled. Strengthening primary care through data-driven improvement therefore requires attention to these connective roles as much as to the measurement frameworks themselves.

Implications

These findings suggest that strengthening indicator-based improvement in primary care requires coordinated attention to the conditions that make measurement useful, not only to the tools that make it possible. To strengthen value, incentive design should reward improvement processes and outcomes rather than compliance with reporting mandates, and indicator systems should be co-designed with the clinicians and teams who use them. To strengthen fit, funding models should resource the full implementation system, including facilitation, workforce development, protected time, and ongoing technical support, not only digital tools and reporting infrastructure. To strengthen alignment, commissioning decisions should

prioritise coherent goals over competing mandates, sustained resourcing over short-term funding cycles, and regional infrastructure that supports local adaptation and shared learning. Additionally, commissioning and workforce strategies should explicitly fund and develop the connective roles that perform the bridging and brokering work of translating shared purpose into practice, including practice facilitators, embedded data champions, academic partners and regional improvement teams, and the training pipelines that produce them. Taken together, these recommendations point beyond individual tools or incentives toward the system conditions on which data-driven improvement depends. Emerging approaches to whole-system performance measurement in primary care suggest the field is moving in this direction, recognising that effective measurement must integrate social, operational and technological factors and be tailored to regional and local contexts if it is to drive improvement rather than compliance (87). Together, value, fit and alignment describe the sociotechnical foundations required for primary care to function as a LHS, one in which routine data becomes a means of continuous learning and improvement, advancing the broader goals of the PHC approach (8,17).

Strengths and limitations

Strengths of this systematic review include broad synthesis of evidence across diverse primary care settings and evidence derived from multiple methods. This synthesis enabled rich interpretation of user experiences and the contextual conditions shaping indicator use and revealed cross-cutting interdependencies of these conditions. Limitations of this review primarily stem from heterogeneity of data across settings, study designs and objectives, which constrained direct comparability. However, this heterogeneity also exposed consistent patterns in the data, strengthening the inferences that could be drawn about indicator use in primary care. Future research should focus on examining barriers and facilitators stratified by

funding model or policy priorities in different health settings. Inclusion of non-OECD and non-English language contexts would improve the transferability of findings by capturing a broader range of health system structures and sociotechnical environments.

Conclusion

Across 26 studies, this review demonstrated that indicator-based improvement in primary care succeeds or fails as a system, not as a standalone tool. Facilitators and barriers appeared to operate interdependently: indicators most often gained traction when value, fit and alignment, converged across clinical practice and the wider system, brokered into place by the actors who worked between them. Where this occurred, data became meaningful and manageable, teams felt able to act, and cumulative cycles of improvement took hold. Where value, fit and alignment did not converge, initiatives added burden and were ignored or abandoned. Sustained use required adaptive support, workable digital and data infrastructure, distributed leadership, and coherence between policy intent and everyday clinical practice. Strengthening these mutually reinforcing conditions, rather than addressing isolated barriers, offers a more realistic path toward embedding indicator use in routine practice, and brings primary care closer to the aspirations of an LHS.

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596 ***Data availability statement***

597 Data sharing is not applicable to this article as no new datasets were generated during the
598 current study. The data supporting the findings of this review are the published studies listed
599 in the reference list, all of which are available in the public domain.

600 ***Code availability statement***

601 No custom code was developed or used in this study. Data extraction, screening, and quality
602 appraisal were conducted using Rayyan QCRI, Covidence, and REDCap. Thematic analysis
603 was conducted using NVivo (QSR International). All software used is commercially
604 available.

605 ***Consent to Publish declaration***

606 Not applicable

607 ***List of Abbreviations***

608 **A&F** Audit and Feedback

609 **CQI** Continuous Quality Improvement

610 **EHR** Electronic Health Record

611 **EMBASE** Excerpta Medica Database

612 **GP** General Practitioner

- 613 **IOM** Institute of Medicine
- 614 **LHS** Learning Health System
- 615 **MMAT** Mixed Methods Appraisal Tool
- 616 **OECD** Organisation for Economic Co-operation and Development
- 617 **PDSA** Plan-Do-Study-Act
- 618 **PHC** Primary Health Care
- 619 **PRISMA** Preferred Reporting Items for Systematic Reviews and Meta-Analyses
- 620 **QI** Quality Improvement
- 621 **REDCap** Research Electronic Data Capture
- 622 **RQ** Research Question
- 623 **UK** United Kingdom
- 624 **US** United States
- 625 **WHO** World Health Organisation
- 626
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- 628 **Ethics Approval and consent to participate**
- 629 Not applicable. This study is a systematic review of published literature and did not involve
- 630 primary data collection from human participants.

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637 **Conflicts of Interest**

638 B.F. is employed by Western Victoria Primary Health Network (WVPHN) and undertook this
639 systematic review as part of a doctoral research pathway within that employment. The
640 authors declare no other competing interests.

641 **Author Contributions**

642 GF, LAE and BF conceived the study and developed the protocol. GF led the initial search
643 strategy. BF, GF, SSp, SSh, and MS conducted title and abstract screening and data
644 extraction. Thematic analysis was conducted by BF and GF, with SSp contributing to sense-
645 checking and interpretive review. BF wrote the main manuscript text and prepared the figures
646 and tables. JB, GF, and LAE provided supervision and made substantial contributions to
647 study design, data interpretation, and manuscript development throughout. All authors
648 reviewed and approved the final manuscript.

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