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Patient-generated health data in primary care: A Scoping Review of digital modalities, care phases, and service-level implications

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Abstract

Objective: This scoping review mapped empirical evidence published up to September 2026 on the use of digitally collected patient-generated health data in primary care. We characterized the technologies, PGHD types and collection modes, mapped their use across phases of care, and synthesized reported implications for primary-care service delivery.

Methods: We searched Scopus, Web of Science, PubMed, EBSCOhost, IEEE Xplore and ACM Digital Library databases. Qualitative content analysis and thematic synthesis was used to classify the digital technologies and PGHD types and identify factors influencing implementation. Life-long personalized Continuum of Integrated Care model was used to map PGHD across the care pathway.

Results: Twelve articles met the inclusion criteria. Most studies were conducted in the United States. Only three articles evaluated existing or currently operating solutions. PGHD were most frequently discussed in pre-acute, post-acute, and homecare phases. Common PGHD types included questionnaires or surveys, locomotion metrics and blood biomarkers. Reported implications concerned funding

and resources, time and workflow, patient and provider experience, and quality or service provision as well as quality of care. These implications were bidirectional and depended on interoperability, data usefulness, review responsibility, training, reimbursement, and operational support.
Conclusions: The available evidence suggests that PGHD does not produce a uniform effect on primary-care services. Future studies should report how PGHD are integrated into workflows, who reviews them, what resources are required, and whether use is sustained in routine practice.

Keywords: Digital Health, Patient-Generated Health Data, Primary Care

1 Introduction

In the field of healthcare, primary care has been seen as a crucial player in the integration with its central role in the delivery of medical care [1]. As a broad and multifaceted concept, primary care's precise definition varies depending on the country and healthcare system it is provided in. The World Health Organization defines primary health care as "whole-of-society approach to effectively organize and strengthen national health systems to bring services for health and wellbeing closer to communities." [2].

Primary care represents a critical setting for the integration of data, given its role as the cornerstone of the healthcare system and essential resource in providing preventative care, chronic disease management continuity of care, and its responsibility for providing comprehensive coordinated care [3]. Provision of primary care stages can be viewed as a pathway and models such as the Life-long Personalized Continuum of Integrated Care model show how care in organized across the well-being, pre-acute, acute, post-acute, and homecare phases [4].

Shifts in patients' health needs and growing interest in consumer-grade wearable devices have changed how individuals manage their health and access care which has sparked discussions across healthcare systems about integrating this data into clinical workflows [5]. Numerous pilot studies have examined the feasibility, acceptability, and technical performance of these technologies across different healthcare contexts

[6, 7]. Research continues to demonstrate considerable interest in leveraging patient-generated health data (PGHD) also by physicians to treat conditions related to lifestyle (diabetes, cardiovascular diseases), and obesity, and in domains with high levels of uncertainty, such as infertility [7].

According to the Office of the National Coordinator for Health and Information in the USA the definition of Patient-Generated Health Data is being health-related data created, recorded, or gathered by or from patients (or family members or other caregivers) to help address a health concern [8]. PGHD includes, but is not limited to, health history, treatment history, biometric data, symptoms, and lifestyle choice [8]. PGHD is distinct from data generated in clinical settings and through encounters with providers in two important ways. Firstly, the patients, not providers, are primarily responsible for capturing or recording these data and secondly, patients decide how to share or distribute these data to health care providers and others [8].

PGHD is commonly grouped into patient-reported data (e.g. health and treatment history, lifestyle patient-reported outcomes) and patient-measured biometric data [9]. For the purposes of this review, we adapted the categorization proposed by the Agency of Healthcare Research and Quality as the primary framework for classifying PGHD types [10].

The complexity of this data rich environment has been tried to solve via health technologies (also called digital health or e-health) that are defined as a broad scope of categories that use computing platforms, connectivity, software, and sensors for health care and related uses [11]. The uses are expansive, ranging from applications in general wellness to applications as a medical device including technologies intended for use as a medical product, in medical products, as companion diagnostics, to adjuncts to other medical products (devices, drugs, and biologics) [11].

The key question is not simply whether digital technologies can collect PGHD, but how these data are incorporated into primary-care delivery, including where they

are used in the care pathway, who reviews them, how they are interpreted alongside clinical information, whether they influence communication or follow-up, and what resources and responsibilities are required [7, 12–14]. Growing interest in applying artificial intelligence (AI) in primary care makes these questions about the practical use of digital data increasingly relevant [15]. A synthesis organized around these links can distinguish technical availability from operational use and from reported service-level implications.

Existing research has largely focused on specific interventions, disease areas, or technological solutions in isolation [16]. Many studies evaluate usability, patient adherence, or clinical outcomes within controlled or pilot environments [17, 18], but there are no recent overviews examining how PGHD and associated health technologies have been integrated into routine primary care practice.

Although the feasibility and usability of technologies for collecting patient-generated health data (PGHD) have been widely studied, evidence concerning their sustained integration into routine primary care remains limited [19]. In particular, it remains unclear which organizational, financial, and operational factors enable PGHD to progress from technical implementation to routine clinical use [19]. Existing reviews have not comprehensively examined the distinction between the technical capability to collect PGHD and its operational integration into primary care services [20]. Furthermore, the literature has not been systematically mapped to determine how the use and perceived value of PGHD vary across phases of the care pathway [4], or how the reported implications for service provision differ according to the maturity of implementation [17]. Addressing these gaps requires consideration not only of whether PGHD technologies are feasible or effective, but also of how their implementation influences clinical workflows, staff roles and responsibilities, resource and time requirements, and the potential for sustained use in routine care [21, 22].

A scoping review approach was considered appropriate because the review questions were broad and exploratory, and the relevant literature encompassed heterogeneous technologies, types of PGHD, study designs, implementation contexts, and service-level outcomes. This approach enabled the breadth and characteristics of the available evidence to be mapped, the use of PGHD across different phases of care and levels of implementation maturity to be examined, and gaps in knowledge regarding its integration into routine primary care to be identified.

Accordingly, this scoping review aimed to map and synthesize the available evidence on the use of digitally collected and analysed patient-generated health data in primary care and the reported implications of their use for service provision. Specifically, the review examined the technologies and types of PGHD used, their application across different phases of the care pathway, the maturity of their implementation in real-world practice, the factors influencing their integration into routine care, and their reported implications for the organization and delivery of primary care services.

The main review question was: How has digitally collected and analysed patient-generated health data influenced primary healthcare service provision?

The review is further guided by the following sub-questions:

1. What types of digital technologies have been used to collect and analyse PGHD?
2. What types of PGHD have been used?
3. At which stages of the patient care pathway has PGHD been used?
4. To what extent does the literature describe real-world implementation beyond pilot or feasibility studies?
5. What factors influence the implementation of PGHD in primary care?

2 Methods

This scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews [23]. The review followed the methodological framework outlined by the JBI, including the identification of the research question, development of inclusion criteria, systematic searching, study selection, data extraction, and synthesis of results. Reporting of this review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist [24]. The checklist can be found as Additional file 1.

Qualitative content analysis and thematic synthesis was used to classify the digital technologies and PGHD types and identify factors influencing implementation. Initial categories were informed by the WHO Classification of Digital Interventions, Services and Applications in Health [25] and the Agency for Healthcare Research and Quality guide to PGHD integration [10]. These classifications were not applied unchanged because neither provided the granularity nor contextual fit required for this review.

The types were further analysed using the life-long personalized Continuum of Integrated Care model [4] delivery in which PGHD were applied. The model envisions a holistic approach to preventative and personalized patient care from well-being to post-acute homecare.

The five phases of the continuum of care include:

1. Well-being – prevention and prediction
2. Pre-acute – Precaution (delaying acute phase) and monitoring.
3. Acute – Diagnostics, precise therapy, in-patient care, monitoring during acute phase
4. Post-Acute – rehabilitation, education
5. Homecare – supporting healthy living, remote monitoring to improve quality of life, healthy living

During data charting, we identified an additional distinction in how patient-generated health data (PGHD) were collected and classified the methods as active when patients manually recorded data, passive when devices captured data automatically, or mixed when both methods were used [16].

No review protocol was prospectively registered. The absence of a registered review protocol is reported as a limitation.

2.1 Search strategy

Included databases consisted of broad interdisciplinary databases (SCOPUS, Web of Science), databases for medical research (PUBMED, EBSCOhost) and technical databases (IEEE Xplore, ACM Digital Library). The search strategy, including all identified keywords and index terms, was adapted for each included database. Only studies in English were included and the initial search did not have and date range restrictions.

Initial search and extraction of papers was conducted in November 2025, and new papers were screened in September 2026.

Full search string and details on database example is added to Appendix A.

2.2 Eligibility criteria

Eligibility criteria were designed to identify empirical studies examining digitally collected PGHD within primary care and its implications for care processes, organization, or service provision. All empirical study designs were eligible, while studies focusing exclusively on technical performance or patient-level outcomes without a clear connection to primary care delivery were excluded. All inclusion and exclusion criteria are presented in Table 1.

Table 1 Eligibility criteria

Criteria	Inclusion criteria	Exclusion criteria
Phenomenon of interest	Studies explicitly addressing PGHD collected, recorded, or shared using digital health technologies.	Studies not involving PGHD or examining only data generated by healthcare professionals or institutions.
Digital technology	Mobile applications, wearable devices, remote-monitoring systems, connected medical devices, electronic questionnaires, or comparable digital technologies.	Studies involving no digital component or examining only non-digital data-collection methods.
Healthcare context	Studies situated in primary care or involving a clearly defined primary care role in the collection, interpretation, or use of PGHD.	Studies conducted exclusively outside healthcare or in other healthcare settings without a clear connection to primary care.
Focus of the study	Studies examining implications for care processes, workflows, organization, coordination, resource use, access, or service provision.	Studies addressing technical performance, device accuracy, algorithm development, or patient-level outcomes without implications for primary care delivery.
Evidence type	Empirical studies reporting findings from completed research, regardless of whether quantitative, qualitative, or mixed methods were used.	Untested or hypothetical concepts, study protocols, proposals, editorials, commentaries, and purely descriptive technical reports without empirical evaluation.
Publication status and availability	Peer-reviewed articles for which the full text was available.	Non-peer-reviewed publications and records for which the full text could not be obtained.
Publication date	No publication-date restrictions were applied.	Studies were not excluded solely because of their publication date.

2.3 Study selection

Following the search, all identified sources were collated and uploaded into systematic literature review management platform Rayyan [26] and duplicates removed. Titles and abstracts were independently screened by the first two authors for assessment against the inclusion criteria of the review. Potentially relevant sources were retrieved in full added to Rayyan. The full text of selected works was assessed independently in detail against the inclusion criteria by the two first authors. Reasons for exclusion of sources of evidence at full text that do not meet the inclusion criteria were recorded and are reported in the scoping review. Any disagreements that arose between the

reviewers at each stage of the selection process were resolved through discussion. The results of the search and the study inclusion process are reported in full in this review and presented in a PRISMA flow diagram [27].

2.4 Data extraction and analysis

Data were charted from the full texts of all included articles using a structured spreadsheet developed around the review questions. The extracted variables comprised bibliographic information, country, study design, participant characteristics, clinical context, type and purpose of the digital technology, type of patient-generated health data (PGHD), method of data collection, transmission or integration pathway, phase of care, implementation status, factors affecting implementation, and reported effects on primary healthcare service provision. Information that was not clearly reported in an article was recorded as not reported rather than inferred.

The first author conducted the primary data extraction and coding. The second author contributed to the thematic analysis and review of the resulting thematic structure. Interpretive differences and uncertain classifications were discussed until agreement was reached. Data charting and category definitions were refined iteratively when clarification was required during analysis, while retaining alignment with the review questions.

Each included article was treated as a separate report. Reports arising from the same underlying study were linked during data charting. Antonio et al. (2022) [28] and Davis et al. (2022) [29] were identified as companion reports. Relevant information from both reports was retained, while overlapping findings were combined during thematic synthesis to avoid treating them as independent evidence. Descriptive frequencies were calculated at article level and therefore represent the number of articles reporting a characteristic, rather than the number of independent studies.

3 Results

The corpus of identified papers included 238 papers. After removing duplicates in the search results, we screened 180 titles and abstracts. Of the 80 articles that underwent full-text screening, we included 12 articles. No articles were added from backwards and forward searches.

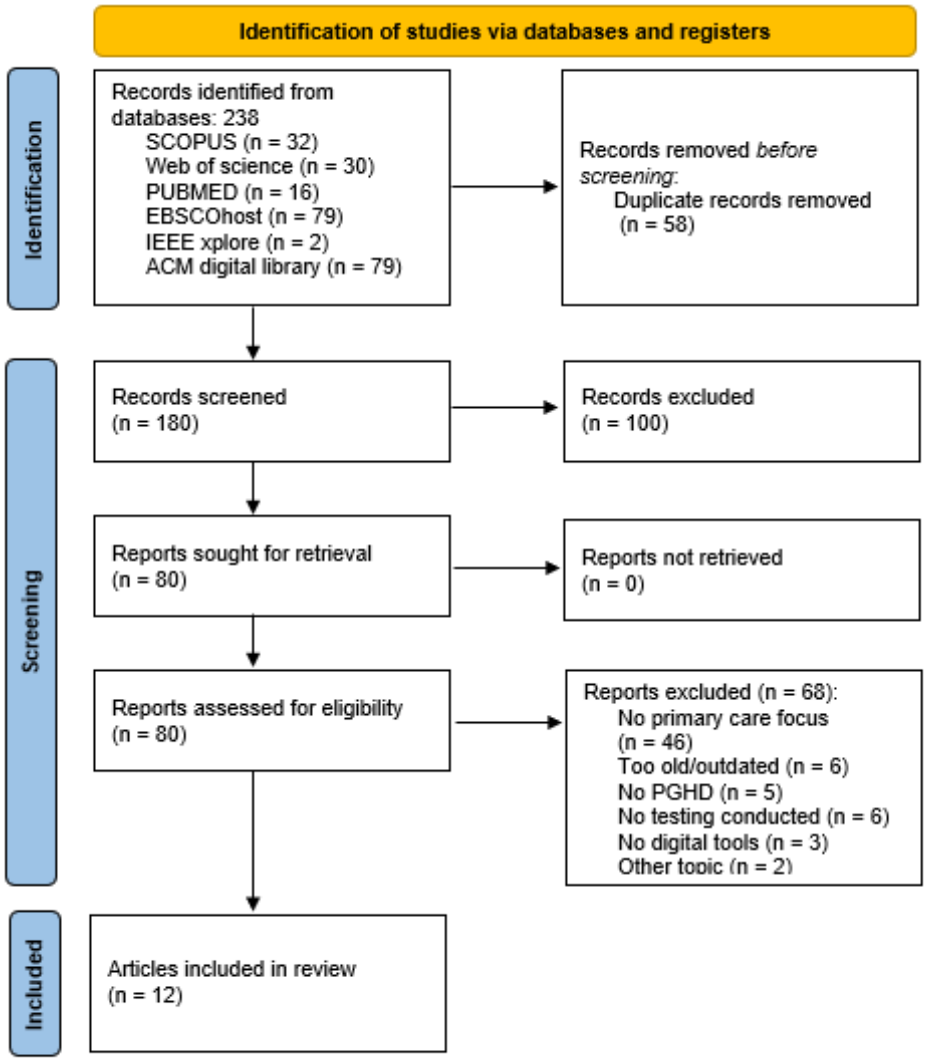


Fig. 1 Flow diagram of the study selection process.

Most of the articles excluded in the title and abstract screening stage did not include PGHD, primary care, or were conference proceedings with no full text available.

In the full-text screening stage, the common reason for exclusion was the lack of focus on primary care. In addition, several articles were excluded because the results had become redundant over time, there was no PGHD involved in the study, no health technologies were used, no testing or proof for theories was provided or the articles were focused on a different topic.

Only sources of reporting findings from completed studies were eligible for inclusion. Study protocols, ongoing studies without reported results, and proposals were excluded. Articles that consisted solely of technical system descriptions, were overly generic without a clear focus on primary care or centred on other professional groups were excluded.

The study-selection process is presented in Figure 1, the full list of included studies is in Table 2, and the list of excluded articles is in Additional file 2.

3.1 Characteristics of included articles

The year of publication ranged from 2020 to 2025 indicating that health technologies and PGHD integration into primary care is a relatively new concept in research. Studies were conducted mostly (66.7%) in the United States of America (USA) with other countries appearing only once each. Most frequently discussed therapeutic areas were hypertension and diabetes. One paper addressed more than one disease, and two did not specify a specific treatment area.

The papers demonstrated substantial heterogeneity in their design. At article level, the reported study designs and approaches were feasibility or pilot studies (n=3), intervention/program evaluation studies (n=3), randomized controlled trials (n=2), qualitative interview studies (n=2), and design/development case studies (n=2). Overall, the evidence base was dominated by early-stage, exploratory, and implementation-focused designs rather than large and controlled trials.

Detailed characteristics of the included articles are presented in Table 2.

Table 2: Overview of included studies

Study	Country	Study design	Therapeutic area	Health technology and complementary methods	Type of PGHD	Implementation status
Antonio et al. (2022) [28]	Canada	Qualitative + design research (method development study)	Mental health	Phone, virtual meeting tools, mobile technologies, patient portal, EMR	Self-action plan, questionnaires	No implementation reported
Saver et al. (2023) [30]	USA	Descriptive case study (development experience)	Hypertension in diabetes; HIV	Smartphone app, smartwatch, blood pressure cuff, near-field communication (NFC)-tagged medication bottles, EHR (EPIC)	Blood pressure	No implementation reported

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Table 2 – Overview of included studies (continued)

Article	Country	Study design	Therapeutic area	Health technology and complementary methods	Type of PGHD	Implementation status
Bardram et al. (2023) [31]	Denmark	Feasibility study (pilot deployment)	Type 2 diabetes	Smartphone, intelligent report for provider data visualisation; complementary paper forms	Steps, blood glucose, smoking, weight, alcohol, lifestyle, emotional distress, well-being, diet and exercise, areas of concern, food behaviour, sleep, depression and anxiety, medication behaviour	No implementation reported; feasibility study
Root et al. (2022) [32]	USA	Randomized controlled trial	Diabetes mellitus	Patient portal, EMR and provider portal	Blood glucose	No implementation reported
Gunn et al. (2024) [33]	USA	Mixed-methods retrospective case study	Hypertension	iPhone (iHealth app), blood pressure cuff, patient portal, EHR	Blood pressure	No implementation reported; pilot study

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Table 2 – Overview of included studies (continued)

Article	Country	Study design	Therapeutic area	Health technology and complementary methods	Type of PGHD	Implementation status
Suija et al. (2022) [34]	Estonia	Qualitative study (interviews)	General primary care	Patient portal and provider-viewed health portal	Pre-appointment questionnaires, blood pressure, diet and pain diaries	Partially implemented; existing practices in Estonia in 2022
Young et al. (2020) [35]	USA	Randomized controlled trial	Type 2 diabetes	Smartwatch, EHR	Blood glucose, steps, distance walked, active minutes, heart rate and sleep duration	No implementation reported
Daughtry et al. (2025) [36]	USA	Pilot intervention study (quasi-experimental)	Hypertension	App, text messaging, Twistle portal, EHR; complementary prerecorded landline messages	Blood pressure	No implementation reported; pilot study

Continued on next page

Table 2 – Overview of included studies (continued)

Article	Country	Study design	Therapeutic area	Health technology and complementary methods	Type of PGHD	Implementation status
Oh et al. (2022) [37]	USA	Qualitative study (interviews)	Not specified; clinics included primary care, women's health, immunization/allergy and alternative medicine	Mobile app, smartwatch; complementary mental tracking and paper journals	Tracked and shared data differed; examples included exercise, sleep, weight, food, water, heart rate, mood, menstrual cycle, stress, blood pressure, steps, temperature, height, calories, inhaler score, cholesterol, sexual life, medication, SpO_2, peak flow, pulse, medical history, drinking habits, caffeine, blood tests, blood glucose, birth control, pain, family health, alcohol and symptoms	Implemented; existing practices in 2022

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Table 2 – Overview of included studies (continued)

Article	Country	Study design	Therapeutic area	Health technology and complementary methods	Type of PGHD	Implementation status
Davis et al. (2022) [29]	Canada	Mixed-methods exploratory feasibility study	Mental health	Web portal, EMR	PREM and PROM surveys: KB Patient Experience Survey, Patient-Reported Outcomes Measurement Information System General Self-Efficacy Short Form 4a, PHQ-9, GAD-7 and a self-action plan for depression	No implementation reported; feasibility study
Annis et al. (2020) [38]	USA	Case study/program evaluation	COVID-19	GetWell Loop platform, EHR	Textual information and pulse oximetry data	Implemented; the system had previously been used for surgical recovery

Continued on next page

Table 2 – Overview of included studies (continued)

Article	Country	Study design	Therapeutic area	Health technology and complementary methods	Type of PGHD	Implementation status
Freytag et al. (2022) [39]	USA	Feasibility study with case series	Dementia	Pendant, EHR; complementary paper movement diary and audio recordings	Postures, walking characteristics, sleep parameters and postural transitions	No implementation reported; feasibility study

3.2 Digital Health Technologies and Complementary Methods

The health technologies identified in the reviewed papers were grouped into three categories: patient-facing, clinician-facing, and complementary methods. Patient-facing technologies were used directly by patients to support self-management, monitoring, education, or communication. Clinician-facing technologies were tools designed to support healthcare professionals in clinical decision-making, documentation, workflow, or treatment delivery. Complementary methods refer to other tools used to collect or share PGHD that were used in addition to health technologies. Patient-facing systems were grouped into wearables, smartphone applications, medical devices, and web solutions, meaning online interfaces provided to the user. Provider-facing systems consisted of Electronic Medical Record (EMR) or Electronic Health Record (EHR) and web solutions. Complementary methods discussed in the papers were tracking data in the patients' heads (memorizing), paper journaling, audio recordings and using traditional landlines. Included studies had both devices and software as the digital technology used. The number of digital technologies discussed in the papers is presented in Figure 2.

3.3 Patient-Generated Health Data types

The PGHD types discussed in the papers were divided (with times used/discussed in different papers) into: Patient-reported data and biometric data presented in Figure 3.

The most often used and discussed data through queries and prompts were patient-reported outcomes via questionnaires and surveys (e.g., KB Patient Experience Survey; GAD-7 anxiety measure; PHQ-9 depression measure), biometric data regarding results from different blood tests (glucose, cholesterol and locomotive characteristics (steps taken; time and distance walked). Other more often discussed types were food/diet behaviour, emotional distress and well-being, blood pressure measurements, and sleep

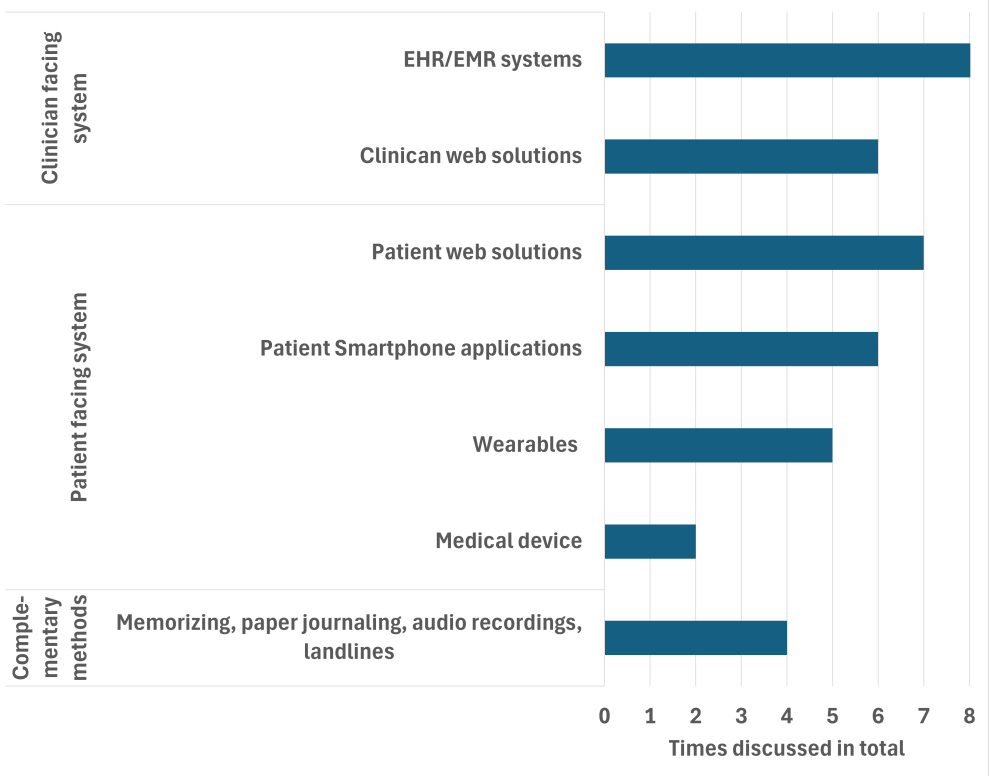


Fig. 2 Types of patient-generated health data identified in the included studies.

characteristics. Other types were less frequently mentioned (usually only once or twice).

3.4 PGHD distribution according to the Continuum of Integrated Care model

The mapping of included articles based on the Continuum of Integrated Care model demonstrates patterns of how the use and type of PGHD applies throughout different phases of care. We could view the way data was collected, ranging from active patient-reported data collection to passive or sensor-based data collection.

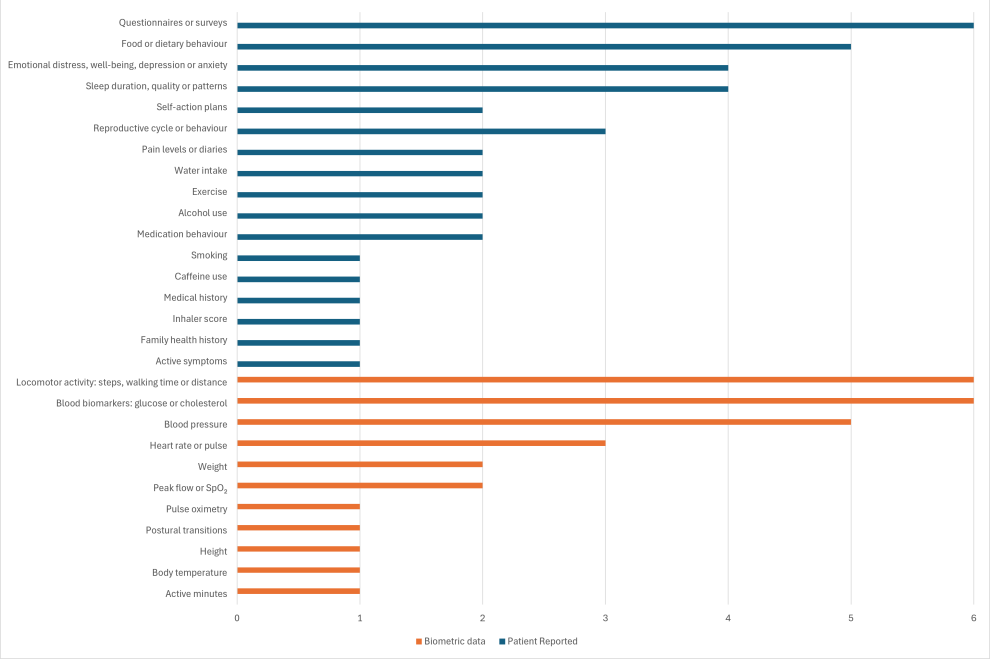


Fig. 3 Types of patient-generated health data identified in the included studies.

The synthesis of findings reported in the included articles suggests that PGHD can be extensively utilized in the pre-acute, post-acute and homecare phases, where continuous monitoring and patient engagement are most critical. However, the use of PGHD in the acute phase remains comparatively limited, as clinical data predominates in this phase. Overall, active data collection is especially visible in studies using questionnaires, self-action plans, symptom reporting, pain diaries, diet diaries and manually measured home blood pressure or glucose. Passive or sensor-based data collection is more common in studies using wearables, mobile health tools, remote monitoring devices and automatically captured activity like sleep, heart rate, posture, or movement data. Mixed data collection appears particularly important for long-term care and chronic disease management, where both patient-reported context and automatically collected physiological or behavioural data are needed to support continuous and personalized care. A detailed mapping of the studies can be found in Additional file 3.

3.5 Real-world implementation

Most of the included articles (n = 9) examined feasibility of proposed solutions or reported pilot and case study findings, but did not provide evidence of subsequent real-world implementation, sustained use, or ongoing operational deployment. Only three articles reported results of an existing solution or current practices. Overall, the literature presented both benefits and limitations of the approaches discussed; however, it did not appear to offer many clear success stories or broader, practice-oriented overviews demonstrating successful implementations at a larger scale.

3.6 Reported service-level implications of PGHD in primary care

To answer the main question of how digitally collected and analysed patient-generated health data influenced primary healthcare service provision, different reported direct and indirect impacts covered in the papers were extracted, grouped into themes and categorized as either having a negative or positive influence on primary healthcare service provision.

The findings of implementing PGHD in primary care show that the topic is multi-dimensional and context-dependent. Impact is shaped not only by the availability of PGHD, but also by how well the data are integrated into workflows, how reliable and useful data is, and whether healthcare organizations have the technical, financial and human capacity to support PGHD use.

Qualitative content analysis and thematic synthesis identified four themes describing the reported effects of PGHD on primary care service provision: funding and reimbursement, patient and provider satisfaction, time use, and service quality, including care processes and quality of care.

All themes identified in the analysis are presented in Figure 4.

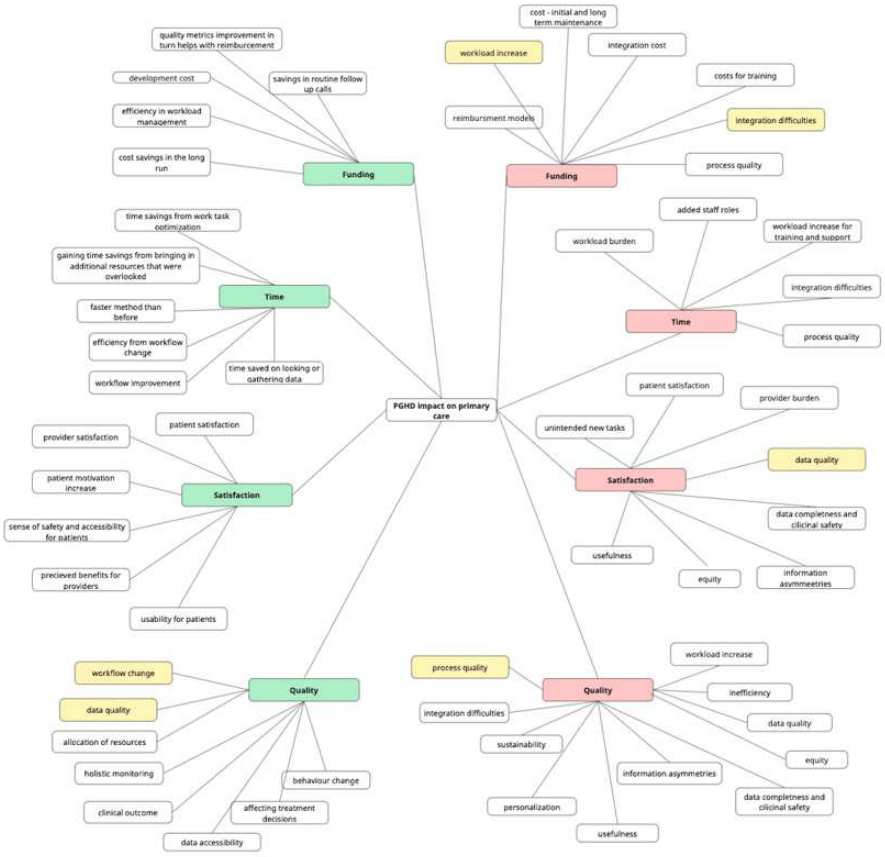


Fig. 4 Themes in PGHD usage. Green: positive impact; Red: negative impact; Yellow: sub-themes overlapping across multiple dimensions

The included articles show PGHD impact across four dimensions: funding, time, satisfaction and quality were context-dependent and bidirectional. Integration difficulties emerged as overlapping sub-themes influencing multiple outcomes simultaneously.

PGHD can reduce costs, but sustainability is threatened by fee-for-service reimbursement models that don't account for collection, analysis, and personnel costs. Studies documented costs for devices, software, IT infrastructure, and training which

is worsened by poor EHR integration requiring manual data entry. Long-term value depends on reimbursement reform, system integration, and sustained funding.

Technologies can optimize workflows and reduce follow-up time, but poorly integrated systems introduce extra tasks and manual data entry, increasing workload. Negative impacts predominated for new or unanticipated use cases. Time savings require deliberate workflow redesign, training and staffing adjustments.

Included studies show that patients valued convenience and self-management support; providers valued clinically relevant, actionable data. Satisfaction decreased with poor usability, integration issues, or increased workload. Barriers included accessibility gaps, privacy concerns, unclear responsibilities and uncertain clinical value. Satisfaction peaked with simple, trusted systems embedded in existing workflows. PGHD can improve quality through holistic monitoring, early symptom detection and informed decision-making. However, inequitable access, poor interoperability, and workflow burden limit effectiveness. Quality improvements occur when technologies are accessible, trusted, actionable and embedded in workflows.

PGHD effectiveness depends more on organizational factors (workflow integration, training, funding) than technology quality. Reimbursement reform seems to be essential. Technical interoperability alone is insufficient without parallel workflow redesign.

Three recurring implementation considerations factors seem to determine success: seamless workflow integration without manual workarounds; clear staff responsibilities and adequate training; reimbursement models accounting for implementation costs. Technical capacity alone is insufficient.

The same factor produces opposing effects depending on implementation. Well-integrated systems improve efficiency; poorly integrated systems increase burden. Complete data enriches decisions; incomplete data erodes trust. Value-based payment

rewards use; fee-for-service penalizes it. Success depends on implementation choices, not predetermined by technology.

All of the extracted features can be found in Additional file 4.

4 Discussion

This scoping review aimed to map and synthesize the existing evidence on the effects of patient-generated health data on primary healthcare provision with a focus on digital technologies. The findings demonstrate that PGHD integration into primary care is a relatively new concept in research, and real-world implementation beyond a exploratory design or pilot/feasibility study is rarely documented. Further longitudinal, real-world effectiveness and implementation studies are needed to assess the effectiveness and evolution of including PGHD and the accompanying technologies in time across diverse populations and care settings.

The results show the impact of PGHD integration across four main themes: effects on funding, satisfaction from different stakeholders' viewpoints, impact on time usage, and overall quality of service provision (Figure 4). Impacts were bidirectional and context-dependent- the same factor could produce positive or negative effects depending on implementation conditions. Critical bottlenecks emerged, particularly integration difficulties and data quality concerns, which influenced multiple themes simultaneously. These findings suggest that PGHD effectiveness depends more on how systems are integrated into workflows, trained staff and funded sustainably, rather than on technology capabilities alone.

Despite more than two decades of digital health adoption, evidence on PGHD service-level effects in primary care remains limited. As noted in prior reviews, many studies evaluate usability and feasibility within controlled or pilot environments, not in sustained routine practice [16, 17], and evidence on PGHD integration into primary care workflows remains fragmented [7, 13, 14]. However, our finding that bidirectional

impacts depend on multiple implementation factor-including interoperability, data usefulness, review responsibility, training, reimbursement, and operational support is novel and challenges technology-centred assumptions in prior reviews. Adoption and sustainability depend on organizational readiness, individual capacity, and system-level context as much as technological performance.

These findings have implications for policymakers and healthcare leaders, who may need to develop clearer standards, reimbursement pathways, and infrastructure to support sustainable use of PGHD in primary care.

4.1 Early-stage research concentrated in the United States

The results show the field being relatively new and having mostly early-stage research that is being published mostly in the USA. Previous research in looking at usage of PHGD in healthcare has shown a similar trend. A substantial portion of the available evidence in the field originates from the United States, where policy decisions have been recognized as central to advancing the integration of patient-generated health data (PGHD) [40]. Although it was already noted in 2019 by Nittas et al. [16] that PGHD integration into EHRs appears to be at an early stage this review reveals that in the field of primary care it has still not reached maturity with multiple large randomized controlled trials or overview articles of successful real-world implementations.

Future research could examine further whether these findings hold in other health systems and regulatory contexts. For example, in Europe, the European Health Data Space (the EU's regulation and common health data space for the secure exchange, use, and reuse of health data across Member States) and standards such as FHIR are a step in the right direction because they may reduce future interoperability mismatches, but there is still to be learned whether their implementation somehow starts to support using PGHD in primary care practices.

4.2 Health technologies and PGHD in primary care

Out of the reviewed papers, the health technologies used for PGHD collection and sharing were wearables, smartphone applications, medical devices, EMR-s or EHRs and web portals. These methods were sometimes complemented with traditional methods such as landlines, audio recordings or paper journaling.

Previous research shows that, when looking at PGHD, the most commonly used tools are the same as in our review [40], and the broader literature on PGHD also recognizes additional formats such as health diaries and journals or verbal summaries [41] they are usually not presented together as complementary methods.

The synthesis of included studies suggests that PGHD is used most extensively in the pre-acute, post-acute, and homecare phases, where primary care is currently the main stakeholder in helping people with ongoing monitoring, self-management, and patient engagement. This shows that PGHD can provide great value in primary care settings, where it can support earlier identification of health changes, more personalized follow-up, and continuous care beyond episodic clinical encounters.

4.3 Influence on service provision

Overall, this review shows that including PGHD to primary care service provision can improve efficiency, care quality, and satisfaction, but only when it is well funded, trusted, and integrated into routine workflows. Its long-term value depends on sustainable reimbursement, adequate staffing, training, maintenance, and interoperability. While PGHD may save time and support better coordinated care, it can also increase workload if data review and communication tasks are not built into existing processes. Satisfaction is highest when technologies are simple, useful, secure, and beneficial for both patients and providers; dissatisfaction arises when they add complexity, workload, privacy concerns, or communication gaps.

The findings echo many other papers' results on PGHD usage in healthcare in general. It is known from previous research that infrastructure and technical issues, psychological barriers, and workload-related concerns are one of the main barriers to comprehensively and holistically adopting digital health technologies by healthcare professionals and that deploying training, evaluating healthcare professionals' perception of usefulness and willingness to use, and multi-stakeholder incentives are vital to enhance the adoption [25]. The need for ease of use has also been highlighted. For example, when visualizations that use familiar graph and table formats, although admitting best practices for implementation have not yet been established [10].

4.4 Real-World Implementation

As real-world implementation cases continue to emerge, these should be systematically documented and evaluated to better understand how PGHD performs in routine practice and how fast-developing digital technologies such as generative artificial intelligence can support the adoption of new data sources such as PGHD in ways that genuinely support primary care and not add to workforce burden. This should include identifying best practices from real-world adoption, exploring which implementation strategies improve usability and workflow fit, and determining what level of training is adequate for all parties involved.

These questions are especially relevant as interest in AI-supported solutions grows. Although AI may help process PGHD, it cannot by itself establish when these data are clinically useful or resolve the responsibilities, workflow constraints, staffing needs, and funding barriers associated with their use. The limited evidence on sustained PGHD implementation therefore cautions against assuming that newer technology will overcome challenges that remain unresolved for existing digital approaches. Without addressing those conditions, AI-supported solutions may encounter the same barriers to routine adoption.

4.5 Limitations

A key limitation of the evidence base identified in this scoping review is the scarcity of studies evaluating the real-world implementation of PGHD in routine care. Most included studies were pilots or feasibility studies and therefore primarily captured short-term effects in specific contexts rather than sustained outcomes in everyday practice. The findings should consequently be interpreted with caution and may not be generalizable across primary care settings.

5 Conclusions

Overall, the reported influence of digitally collected and analysed PGHD on primary care service provision was mixed and context dependent. The reported effects of PGHD on primary care provision included implications on funding and resources, time and workflow, patient and provider satisfaction, and service quality. PGHD supported monitoring, coordination, and more informed decisions when data were clinically useful, trusted, and integrated into routine workflows. Poor integration, unclear review responsibilities, limited staff capacity, inadequate training, and unsuitable reimbursement models increased workload and costs and reduced perceived value. Depending on the implementers' approach to use of the data, using PGHD can both hinder or support primary care service provision.

The evidence remains immature, predominantly US-based, and dominated by pilot, feasibility, and early implementation studies. Only three of the 12 studies examined existing or operating solutions, limiting conclusions about sustained effects in routine care.

To advance the adoption of digital technologies in primary care, policymakers and healthcare leaders should align technical infrastructure with workflow design, staffing, governance, and reimbursement. More longitudinal implementation studies are needed

to evaluate sustained implementation across diverse primary-care systems and report its effects on service delivery, resources, equity, and patient care.

5.1 Abbreviations

AI	Artificial Intelligence
EHR	Electronic Health Record
EMR	Electronic Medical Record
FHIR	Fast Healthcare Interoperability Resources
GAD	Generalized Anxiety Disorder
PGHD	Patient-Generated Health Data
PHQ	Patient Health Questionnaire
PREM	Patient-Reported Experience Measures
PROM	Patient-Reported Outcome Measures

5.2 Supplementary Information

Additional file 1 (DOCX). PRISMA-ScR checklist. Completed reporting checklist for the scoping review.

Additional file 2 (XLSX). Excluded articles and reasons for exclusion.

Additional file 3 (XLSX). PGHD mapping: Continuum of Care and passive vs active data collection methods

Additional file 4 (XLSX). Overview of included articles. Extracted characteristics and findings of the articles included in the scoping review.

5.3 Acknowledgements

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5.4 Authors´contributions

KN: Conceptualized the review, developed the protocol and search strategy, conducted the literature search, screened and selected the studies, extracted and analysed the data, and drafted the manuscript.

AD: Independently screened studies for inclusion, reviewed the thematic analysis, and critically revised the manuscript.

SM: Provided methodological expertise, oversaw the appropriateness and accuracy of the study design and methodological framework, and contributed to revisions of the manuscript.

KK and PR: Contributed to the conceptualization of the research, provided academic supervision and critical feedback, and substantively revised the manuscript.

All authors read and approved the final manuscript.

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5.6 Data availability

All data generated or analysed during this study are included in this published article and its supplementary information files.

6 Declarations

6.1 Ethics approval and consent to participate

Not applicable.

6.2 Consent for publication

Not applicable.

6.3 Competing interests

The authors declare no competing interests.

Appendix A Electronic search strategy

Search platform: Web of Science (Clarivate).

Search field: All Fields (`ALL`).

Restrictions: No publication-date or language restrictions were applied. No other search filters were used.

Search dates and results: The initial search was conducted on 14 November 2025 and retrieved 24 records. The updated search was conducted on 1 September 2026 and identified six additional records, bringing the total number of records identified from this source to 30.

Full search strategy: The following search strategy was used for both searches:

```
ALL=(("digital health" OR "e-health" OR " health technology" OR
"telehealth")
AND ("patient generated data" OR "patient-generated health data" OR "self
reported data")
AND ("community health" OR "primary care" OR "primary healthcare" OR "family
medicine"))
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