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Contribution of comprehensive primary care in promoting sustainability scalability and innovation of digital technologies – A scoping review

by

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The certificate is awarded to

Dr Saima ZubairAhmed Siddique

In recognition of having successfully completing her internship in the department of

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She comes across as a committed, sincere & diligent person who hasa strong drive & zeal for learning.

We wish her all the best for future endeavors.

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This dissertation has the requisite standard and to the best of our knowledge no part of it has beenreproduced from any other dissertation, monograph, report, or book.

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Abstract

Digital technologies have revolutionized primary health care by providing a plethora of opportunities to improve public health. They have already disrupted education, policy, and practice by creating novel ways of communication, empowerment, and engagement. Primary health care must address key components of digital health like physical infrastructure, deploying appropriate services and applications, developing a competent health workforce, ensuring a sound legal and regulatory environment, as well as improving governance, policy, standardization, and interoperability. Numerous studies have been conducted on how digital technologies in innovations can improve specific aspects of health care, especially primary care, but there is no emphasis on how comprehensive primary care contributes to influencing and sustaining the already implemented technologies. A scoping review was conducted between April 2022-June 2022. Our central theme of the search was what attributes of primary care sustains the digital health innovations? We also investigated the attributes that aid in scalability of these innovations. We used Booth's five stage process for scoping review. Two phase analysis was used to extract and synthesize data from articles. Descriptive analysis was undertaken to categorize papers according to primary and secondary study, articles addressing sustainability, scalability and innovation. Thematic analysis was done on three main groups: Human factors, organizational factors and technology factors. We concluded that the discourse about the role of primary care in sustaining DIH and innovation is imperative. The findings provide an opportunity for policymakers, leaders, and stakeholders to create an enabling environment for Digital health technologies. Moving forward all policymakers, developers, end-users, funders, and researchers must focus on making the PHCs ready for digital health especially in the wake of Ayushman Bharat Digital Mission implementations being planned at state level. The findings require empirical Validation of our findings in a real-world setting.

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Contribution of comprehensive primary care in promoting sustainability scalability and innovation of digital technologies – A scoping review

Introduction

The cornerstone of most health systems is primary care. A Health system with a robust primary health care component produces better and more equitable health outcomes, is more efficient, and can achieve greater user satisfaction compared to weaker ones [(1)]. The ongoing epidemiological and demographic transitions demand more robust and more comprehensive primary care to decrease the inequity in healthcare delivery[2]

Digital technologies have revolutionized primary health care by providing many opportunities to improve public health. They have already disrupted education, policy, and practice by creating novel ways of communication, empowerment, and engagement [3]. The WHO has proposed eHealth as one of its strategies to support the resolution of health problems. eHealth is presented to provide cost-effective and safe use of ICT in healthcare and its related fields[4]. Technologies have influenced the delivery and management of health services[5] they promise to provide solutions to improve primary care; as a result, digital technologies have become essential resources in primary care, and their adoption and implementation are increasing exponentially[6]. Covid-19 pandemic has re-emphasized the need for and importance of digital tools and technology in primary care settings. There has been a wide variety of innovations implemented to improve primary care in many countries, ranging from policy initiatives, like capitated reimbursement, to ground-level improvements, like improving access to primary care practices and enhancing the role of nurses in providing comprehensive primary care. Some technological innovations are digital health assistants to assist with administrative tasks, medical chatbots to engage patients more frequently, and electronic health records and telemedicine[7].

Primary health care must address critical components of digital health like physical infrastructure, deploying appropriate services and applications, developing a competent health workforce, ensuring a sound legal and regulatory environment, and improving governance, policy, standardization, and interoperability[8]. When it comes to primary care services, digital health development meets with a particularly complex healthcare system. This situation presents

four different challenges. First is an organisational challenge, which means that e-Health implementation must consider the organisation. Second, the burden of inequalities is one of the major problems facing the healthcare system, so it is a social and territorial concern. The third challenge is economical since we need to produce new methods to assess e-Health's sustainability internationally over the long run. Finally, new technical and legal challenges must be overcome[9]. As part of comprehensive innovation efforts aim to improvement care, technologies and digital health have yet to contribute significantly. This reflects that such technologies have not reached maturity or gained wider acceptance. To encourage technological innovations and adoption, emphasis must be laid on evidence-based research, financial feasibility, good policy frameworks, and the inclusion of stakeholders in the process[10].

Health systems are known for the slow and unsuccessful adoption of digital health technologies[11]. Factors like health conditions, technology, value proposition, adopter system (comprising professional staff, patient, and lay caregivers), more comprehensive context, and interaction and mutual adaptation influence non-adoption and abandonment. Numerous studies have been conducted on how digital technologies in innovations can improve specific aspects of health care, especially primary care. Still, there is no emphasis on how comprehensive primary care influences and sustains the already implemented technologies. We found only one study by Sibthorpe et al from 2005[12], which has talked about sustainability of primary healthcare innovation, but it was not exclusively related to digital health innovation

This study aims to identify the role of comprehensive primary care centers in adopting and sustaining health technologies and policies and their potential impacts.

Research question:

1. What is role of primary care in sustaining digital health innovation?

2. What factors in primary care influences scalability and spread of Digital health Technology?

Literature review:

Moore, J. E et al. have defined sustainability in the context of five constructs, i.e., “after a defined period”, “continuity”, “individual and organizational behaviour change, evolve or adapt”, and “continuity to produce benefits”[13]. “Sustainability of innovation in organizations can also be stated as the “point at which new ways of working become the norm and the underlying systems and ways of working become transformed in support” [13]. Aarons et al termed it as “continued use of an innovation in practice”. The process through which new working methods, performance enhancements and continuous improvements are maintained for a period appropriate to a given context [14]

The health quality Ontario stated that “fewer than 40% of healthcare improvement activities successfully transition from adoption to sustained implementation that spreads to more than one area of an organization.”[15]

Schlieter et al discussed in detail the factors affecting the scale up of digital health innovations. They identified 36 factors that enables scalability of these innovation i.e., funding, regulatory policies, work culture of organization, social support, usability of technology, quality of information, interoperability, and business models to name a few. They concluded that in order to make the digital interventions sustainable and viable, a culture shift is required, and a great extent to work needs to be done in the area of interoperability which was one of the greatest barriers of scalability of digital health innovations[16].

To make the technologies sustainable in long it is essential to test them against solid frameworks. Sustainability assessment forms a complex form of appraisal method for the existing technology. Sustainability assessment can be better understood as “that can help decision makers and policy makers decide what action they should take and should not take in an attempt to make society more sustainable.”[17]. According to Verheem et al. the primary goal of this assessment is to make sure that interventions make an optimal contribution to sustainable development[18].

Despite to numerous frameworks for sustainability assessment Sala et al concluded that there a need for stronger and solid framework as the existing framework were not comprehensive in the context of integrated assessment[19].

Digital Health innovation drives major changes in the operations of healthcare organizations. Lehoux et al interviewed health innovators in Canada and Brazil to study the factors to operationalize the inclusives of designing process, and to study what effects the system-level changes by their innovation. They concluded that these innovators work towards engagement with stakeholder at all stages but specifically at early stages, positioning of their innovation in health system, and collaborate with the workforce by improving their capacity and autonomy. Their study provides an empirical validation of Responsible innovation in healthcare-oriented roles and responsibilities of the manager can help sustain these technologies in long run[20].

Moucheraud et al studies the factors affecting sustainability of health information system in Southern Africa, namely finance, training, effectiveness, community interactions, integrations and political, economic and cultural characteristic of country. The findings of this study re-emphasized the importance of organizational and environmental factors in the sustainability of technology in healthcare[21].

Methodology

A scoping review was conducted between April 2022-June 2022. Our central theme of the search was what attributes of primary care sustains the digital health innovations? We also looked into the attributed that aid in scalability of these innovations. We used Booth's five stage process for scoping review. (1) Searching databases for relevant articles using keywords in Table 1. (2) searching for peer reviewed relevant data (3) searching for relevant bibliographic articles (4) revision and modification for search strategy and method (5) data extraction and analysis.

Search strategy:

We started by exploring 4 studies to develop our search strategy. We then search articles with the relevant keywords like sustainability, digital health, primary healthcare, innovation, impact, challenges, and opportunities on 5th April 2022. We identified 740 results from PubMed, Wiley, web of science and google scholar using the above keywords. Titles and abstracts have then screened these articles for relevant articles. Inclusion and exclusion criteria were applied as stated below:

Inclusion criteria:

- all the articles discussing policies, human factors, and organizational or environmental factors regarding technology sustainability in healthcare were included.
- Articles from all geographies were included.
- Articles published in English language only
- Full text available
- All articles published in the last five years, i.e., April 2017- April 2022, were included in the study.
- All study designs included

Exclusion criteria:

- We did not consider any study published before April 2017.
- All the studies discussing technology were excluded.
- Articles published in language other English
- Full text articles not available
- Articles not discussing sustainability and scalability innovation in healthcare were excluded.

Table 1: Keywords used for search

(Health OR healthcare OR health care OR health system OR primary healthcare OR primary health care OR primary care Centre OR health services OR health services delivery)

AND

(Sustain OR help OR assist OR encourage OR support OR substantiating OR maintaining OR fostering OR continuing OR backing OR aiding)

AND

(Scale OR spread OR develop)

(Digital Adoption OR Implementation OR factors influencing OR challenges)

AND

(Innovation OR Innovate OR Innovative OR Novel OR Novel intervention OR Pilot OR Prototype OR Feasibility OR Preliminary OR Creative OR New OR Improved OR Diffusion of innovation OR Organizational innovation OR Technological innovation OR Tech innovation OR Scientific Innovation OR Business Innovation OR Health care reform OR Disruptive innovation OR policy innovation OR novelty OR novel)

AND

(Digital technology OR electronic technology OR mobile technology OR e-health OR ehealth OR electronic health OR emerging technology OR emergent technology OR emerging digital technology OR emergent digital technology OR m-health OR mhealth OR mobile health)

We also downloaded the abstracts of all the 740 articles. We performed text mining through PubMed.mineR package using the keywords- "sustainability-healthcare, sustainability-health, sustainability-eHealth, sustainability-health system, sustainability-digital health." We retrieved nine articles through text mining, which were then used in full-text screening.

At the end we included 9 articles for analysis. we documented the 9 articles by extracting data under following heading:

- Citation
- Objective
- Study design
- Year of publication
- Main factors (Human, technical and organizational)
- outcomes

We also used the discussion section of all the nine articles to perform a word cloud analysis using “word it out” software. Word cloud, also called “Tag cloud, “ prvides a visual representation of the most common words and phrases from our database.

Data Analysis:

We used two phase analysis to extract and synthesize data from our articles.

1. Descriptive analysis was undertaken to categorize papers according to primary and secondary study, articles addressing sustainability, scalability and innovation.

2. Thematic analysis was done on three main groups: Human factors, organizational factors and technology factors

Human Factors	Factors related to human resources management
Organizational factors	Factors related to organizational policies, processes, culture etc
Technology factors	Factor pertaining to technology that aids sustainability in healthcare

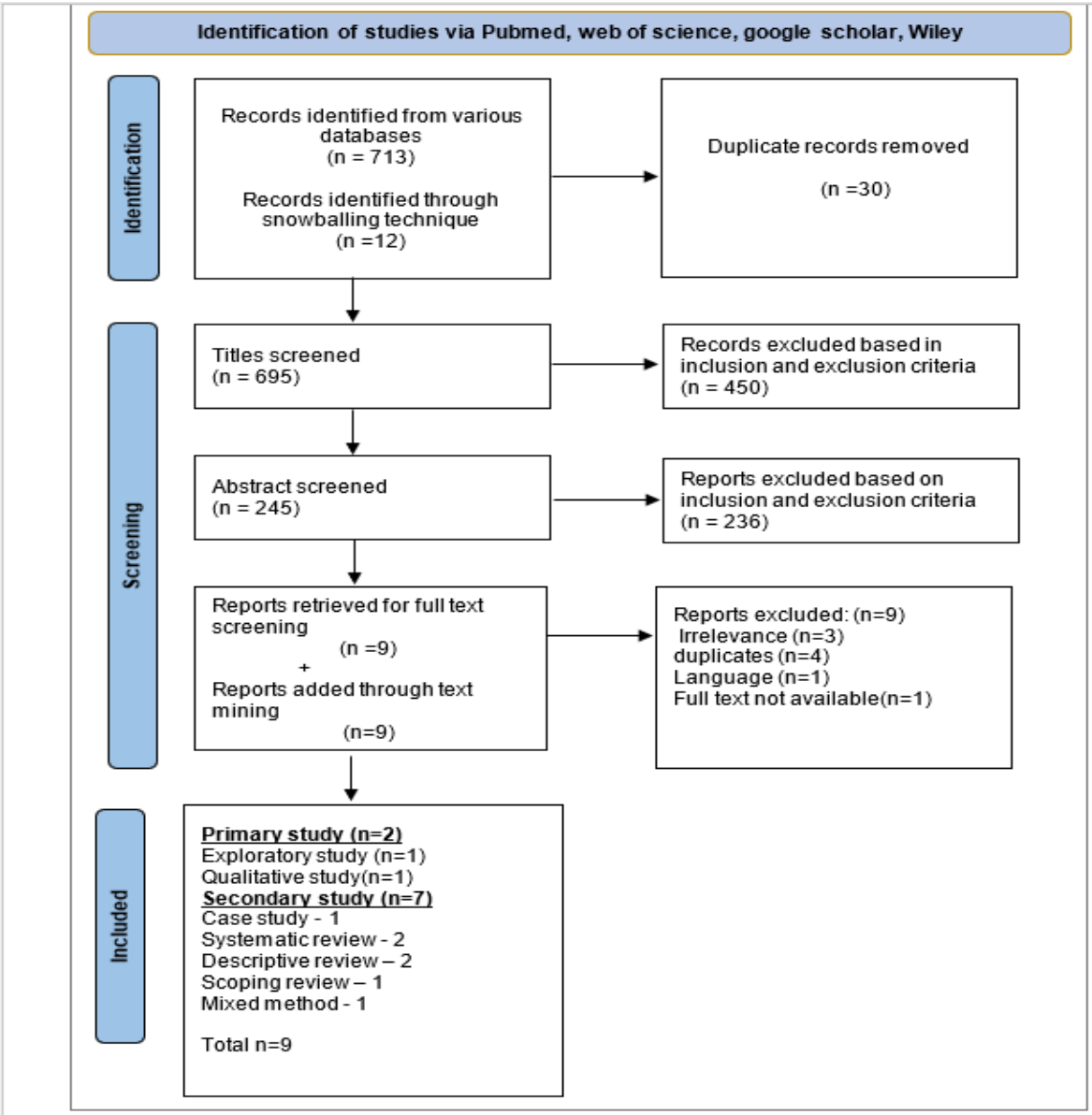

Figure 1: The Prisma chart

Results

To answer our research question, we conducted a comprehensive scoping review, to explore the amount of data available on sustaining and scaling of digital health innovations. We included nine articles in our review out of this 9, 2 where primary studies were secondary studies. The primary study design was exploratory (n=1) and quantitative (n=1). The study designs of secondary articles are case study (n=1), systematic review (n=2), descriptive review (n=2), scoping review (n=1) and mixed method review (n=1).

Of these 9 studies, 8 studies discussed sustainability, 4 discussed scalability, and 7 discussed innovations.

Descriptive analysis: we used descriptive study to categorize amd analyse the primary (n=2) and secondary study (n=7). One of the primary studies is exploratory study and the other one is qualitative study. In secondary articles, case study (n=1), systematic review (n=2), descriptive review (n=2), scoping review (n=1), and mixed method review (n=1). The primary studies were based in Vietnam and Canada. The objective of all the studies vary in different areas of work, (table 2 & 3). The outcomes of these study vary from policy, to aseessment frameworks, to exploring factors affecting digital health innovation. The findings of primay study are explained in Table 1. And findings of the secondary study are explained in table 3.

Table 2: List of the primary studies included in the review

Citation	Year/ country	objective	Study design	outcomes
Urquhart, R et al. Feb-21	Feb-21 Canada	To identify factors and processes influencing the sustainability of innovations in cancer survivorship care.	qualitative study	(1) management support (2) organisational and system-level priorities; (3) key people and expertise. (4) innovation adaptation (5) stakeholder engagement (6) ongoing education and training. (7) widespread staff and organisational buy-in for the innovation.
Dang, T et al. Jun-21	Jun-21 Vietnam	To explore the opportunities, challenges, and necessary conditions for Vietnam in transforming toward a patient-centered care model to produce better health for people and reduce health care costs.	exploratory study	Policy Social Technological economic environmental

Cite	Year	Objective	Study design	outcomes
Braithwaite, J. Et al Apr-18	Apr-18	To describe theoretical frameworks, definitions and measures of sustainability	systematic integrative review	found different deifinitions and frameworks for sustainability and its assessment.
Vidal, M et al. Apr-18	Apr-18 Cuba	to present the achievements made and the challenges that come from the application of eHealth in the Cuban context to support universal health.	descriptive review	advanced models of solidarity Educational and information resourcesfor distance education the possibilities of organizing virtual scientific events, among others, have contributed to the training of human resources
Frost, M. J. Et al. Oct-18	Oct-18 Nost specific	defining stewardship for digital health—and identifying current trends and gaps to address in the future—as a foundational topic in support of the other papers in this issue.	review	Strategic direction policies and procedures Roles and responsibilities health service delivery implications.
Côté-Boileau, É et al. Sep-19	Sep-19	study aims to improve understanding of the 3S of healthcare innovations.	scoping review	Across five key areas of focu (1) focus on the why (2) focus on perceived-value and feasibility (3) focus on what people do, rather than what they should be doing (4) focus on creating a dialogue between policy and delivery (5) focus on inclusivity and capacity building
Mather, C. A. et al Oct-19	Oct-19	Paper offers a model for nurses to assess organisational readiness, to transition into digitally capable health professionals and to support sustainable digitally professional healthcare environments.	Mix method research	4E3P Model: 4E: Equipment, electronic access, engagement and education 3P: Prepared, Proficient and Professional

Jacob C et al.Feb-20	Feb-20	To systematically explore relevant published literature to synthesize the current understanding of the factors impacting clinicians' adoption of mHealth tools, not only from a technological perspective but also from social and organizational perspectives.	systematic review	**Technological factors:** usefulness, ease of use, design, compatibility, technical issues, content, personalization, and convenience **Social and organizational** factors workflow related, patient-related, policy and regulations, culture or attitude or social influence, monetary factors, evidence base, awareness, and user engagement.
McCool, J et al Dec-20	Dec-20	on experiences in designing, implementing, and evaluating digital health initiatives within low resource settings to identify lessons learned about factors that can influence successful and sustainable integration of digital health within local health systems.	case study	1. designing in partnership with stakeholders 2. focusing on equity through design and evaluation 3. building capacity, capability and ownership 4. evaluation tool to be pragmatic

Table 3: Key findings of secondary studies included in the review

Thematic analysis:

All the studies discussed organizational and technological factors, only 8/9 discussed human factors.

Table 4: Thematic analysis

Human factors	**Organizational factors**	**Technological factors**
Upskilling workforce	policies & processes	Implementation
Ownership	Adaptability	cost
Stakeholder partnership	Work culture	User-friendliness
Leadership support	User engagement	workflow integration
Job security	Awareness	Benefits
Career development	Service delivery	Technical support
		Design Compatibility

Human Factors:

All the articles except one discuss about the role of workforce in sustaining the technology in healthcare. We identified most common factors as upskilling the workforce through continued learning, employee buy-in, leadership, stakeholder management capacity building, ownership, job security and career development. The most important factor that works towards sustaining and supporting the technology is continuous education and training of the workforce thereby improving the quality of the human resource.

Cuban health authorities have taken steps to upskill their workforce through e-learning initiatives, these e-learning platforms are integrated into a portal with a virtual classroom, and they provide various learning and training courses. They also support research, service delivery and education.

To build a digital stewardship training and education of the staff is essential and can lead to a health digital health ecosystem. We also found that roles and responsibilities must be precisely defined during the implementation stage. The single most determinant of failure or success of technology is the acceptance by the professional staff

Organizational factors

include Implementation of technologies and assessing it´s sustainability through a well-established framework. Strong policies and procedures to include innovative technologies in the day-to-day routine of the organization. Organizations must ensure creation of a culture of adaptability and change to new technologies. Adequate and appropriate change management is of utmost value. Another factor would be a strategic partnership with stakeholders, and their involvement in all the stages of development, designing and implementation of modern technologies. A highly supportive user engagement and support in all stages of technology implementation before and after is required to sustain the technology in long run. Adoption of innovative technologies causes some changes in the organization, to tackle this change the

leadership must develop and promote policies for better alignment within the organization to negate any ill effects of the change[40].

Technological factors:

Innovative designs for innovative technology solutions must support a wide spectrum of users, both expert and novice, as well as people with different needs and requirements, not only that, but innovations must be functional so as not to create an added burden on the organization's workflow. Organizations must be able to integrate innovative solutions with their existing technological infrastructure[22] and organizations must be able to integrate new solutions with their existing technological infrastructure[23].

Discussion

Our results are categorized as descriptive and thematic analysis. In descriptive analysis we found that there are 2 primary studies and 7 secondary studies including 1 case study, 2 systematic reviews, 2 descriptive studies, 1 scoping review and 1 mixed method review. We also categorized study based on if they covered sustainability, scalability, and innovation. We found that 8 studies covered sustainability, 4 covered scalability and 7 described innovations. Thematic analysis categorized findings into 3 major groups such as human, organizational, and technological factors.

Emilsson et al in their article about sustainable innovation also emphasized that A sustainable innovation needs to have a design that is functional for both healthcare staff and patients. The product should not be too intrusive and should be user-friendly and create a good user experience for users with different needs and requirements[22].

Blakey et al The design should support both the contextual expert user and the novice user of the software or technical solution per say. The innovation must also be compatible with the current computer system and other technical solutions used at the primary healthcare center to not add extra frustration and time to interact with it[24].

Sibthorpe et al identified the inhibitors of sustainability including lack of practice meetings and teamwork and lack of a business model to support the activity[12]. On the other hand, good internal fit between the initiative and other activities supported sustainability. Sibthorpe et al (2005) worked on the same lines and found three themes for sustainability of primary care innovations, the importance of social relationships, networks and champions[12], the effect of political, financial and societal forces, The motivation and capacity of agents within the system, but these factors were not exclusive to digital innovations.

Fagini et al. emphasized on user friendliness of systems, boosting collaboration among stakeholders, change health management promoting smarter and wider use of tools[3]. Brewster et al[25] &Radhakrishnan et al[26] found that Training, promotion, and redefinition of roles were essential for the successful adoption and sustaining of new technologies

The development of capacity and capability is important not only for successful implementation, but also for maintaining and updating digital programmes, expanding them, and extracting data for long-term improvement.

Studies have shown that perceived and real usefulness have a direct impact on adoption and intention to use. Staff are more likely to use a tool when they understand its benefits and find it useful in their daily work and in emergencies. This is sometimes because they are unaware of studies showing effectiveness. Several studies cited layout, interface, and culturally appropriate and patient-centered design as critical factors.

Training is lacking, insufficient, or inadequate[27], there is not enough time to learn how to use the new tools[28], resources are needed to ensure the sustainability of training programs[29], and some of the reasons for this are that technology-only programs do not address workflow changes. Due to lack of integration and interoperability, digital tools have increased workload due to double data entry

Leaders and institutions play an important role in technology adoption[30]. For the new technologies to be successful, management must change responsibilities[31], allocate resources[32], and train staff.

DIT success requires a strong organizational infrastructure[33]. It is important to take into consideration factors such as internet access, equipment, and space and power when considering whether to adopt such innovative technologies [34, 35, 36]. The lack of appropriate equipment may hinder mHealth adoption, since clinicians may not use it because of poor infrastructure[37,38,39]

Privacy and security concerns can prevent adoption of digital health tools due to the large amount of data generated. Even though data privacy and security issues are core of any digital intervention we found only one study discussing it.

We intended to find factors related to primary care centres but none of the study we included exclusively discusses about primary care, these finding can be sued in the context of primary care too.

Strengths and limitation:

This study is the first of its kind, we did not find any study focused on this area of work. We used a robust search strategy utilizing digital tools to make a comprehensive review article. We searched and included a both primary and secondary articles. This study will fill the knowledge gap addressing the impacts of primary care on digital innovation and sustainability. The review provides a changed perspective to make digital innovation & adoption sustainable in health care. Although these studies do not discuss primary care per se, these findings can be adapted to the primary care.

One of our biggest limitations is the lack of primary studies, due to which we had to adopt a mixed methodology. Our study could have benefitted from a more systematic review. Also, we included articles from just English language. We included the articles from last 5 years, more articles could have been found if the time was extended beyond 5 years.

Conclusion

We believe that the discourse about the role of primary care in sustaining DIH and innovation is needed. We Identified three main themes i.e., human, organizational & technological. The findings provide an opportunity for policymakers, leaders, and stakeholders to create an enabling environment for Digital health technologies. Clinical decision makers in primary care need to support a cultural shift. Moving forward all policymakers, developers, end-users, funders, and researchers must focus on making the PHCs ready for digital health especially in the wake of Ayushman Bharat Digital Mission implementations being planned at state level. Assessment of sustainability of technology must be done. This study could be extended by enhancing Time period, language, and grey literature. The findings require empirical Validation of our findings in a real-world setting

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