

A STUDY TO IDENTIFY GAPS AND UNMET NEEDS IN THE DIGITAL HEALTH SPACE

Dissertation Submitted to



The IIHMR University, Jaipur
for the partial fulfillment for the award of the degree of
Master of Business Administration (MBA)

in
Hospital and Health Management

By

Ms. Deepti Kiran

Under the Supervision and Guidance of

Dr. Anupam Mehrotra,
Assistant Professor
IIHMR University, Jaipur

2023

A STUDY TO IDENTIFY GAPS AND UNMET NEEDS IN THE DIGITAL HEALTH SPACE

Dissertation Submitted to



The IIHMR University, Jaipur
for the partial fulfillment for the award of the degree of
Master of Business Administration (MBA)
in
Hospital and Health Managementby

Ms. Deepti Kiran
Under the Supervision and Guidance of

Dr. Anupam Mehrotra,
Assistant Professor
IIHMR University, Jaipur

2023

DECLARATION BY STUDENT

I hereby declare that this dissertation titled “**A study to identify the gaps and unmet needs in the digital health space**” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Ms. Deepti Kiran

Date: 30 May 2023

CERTIFICATE BY ORGANIZATION



Orbees Business Solutions Pvt. Ltd.

Q1, B1, B2, B3, 6th Floor, Cyber Towers, Hitec City, Madhapur, Hyderabad – 500 081. CIN: U72200TG2006PTC049670
Tel: +91 - 040 - 2311 4722, Fax: +91 - 040 - 2311 4723. info@orbees.com | www.orbees.com | www.orbeesmedical.com

22nd May 2023
Hyderabad

To

Ms. Deepti Kiran

Chuna wali gali, opposite to church lane, Hariharganj,
Fatehpur, Uttar Pradesh - 212 601.

Dear **Ms. Kiran**

Internship Experience Letter

This letter also certifies that **Ms. Deepti Kiran** is doing internship with Orbees Business Solutions Pvt Ltd from **21st February 2023 to till date** and her role is Intern – Senior Analyst

We wish her all the best for her future endeavors.

For **Orbees Business Solutions Pvt. Ltd**

Rakesh Valluru
Sr. Manager - Operations



Deepti Kiran

CERTIFICATE BY INSTITUTION

This is to certify that dissertation titled is “**A study to identify the gaps and unmet needs in the digital health space**” a record of the research work undertaken by **Ms. Deepti Kiran** in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Dr. Anupam Mehrotra

Assistant Professor & faculty guide

IIHMR University, Jaipur

Date: 30-May-2023

Dr (Col) Mahender Kumar

Dean IHMR

IIHMR University, Jaipur

Date: 30-May-2023

PLAGIARISM REPORT

This is to certify that the dissertation project report entitled “**A study to identify the gaps and unmet needs in the digital health space**” submitted by Ms. Deepti Kiran for the partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur, has been evaluated for plagiarism by the university.

The thesis has 09% plagiarism on evaluation by Turnitin software.



Source- IIHMR Library

ACKNOWLEDGEMENT

I consider myself extremely fortunate to have had the opportunity to experience and grow at Orbees Medical in Hyderabad. It was an incredible stroke of luck that I was able to be a part of such a prestigious organization. My internship there was a great combination of information and delight thanks to the helpful staff and committed faculty. I am incredibly appreciative of the priceless lessons I have acquired because they have prepared me to perhaps pursue a profession as a research scholar and have familiarised me with the most up-to-date approaches and procedures required for my curriculum. These insights have provided me with a vast array of opportunities, luring me towards a bright future.

This project's completion has required difficult efforts that are absolutely admirable. However, without the constant support and direction of my distinguished external mentor, Mr. Jonathan Pillai, who occupies the esteemed position of Director in the organisation, this achievement would not have been feasible. They have provided me with essential guidance and mentorship during the course of this endeavour.

Additionally, I would like to express my sincere gratitude to Dr. Anupam Mehrotra, my internal faculty mentor, who's active providing of directions substantially aided us in the preparation of this report. I'm also incredibly grateful to our organisation, the Institute of Health Management Research (IIHMR), for giving us the chance to make a statement and demonstrate our expertise on such esteemed stages.

I would also like to express my gratitude to the esteemed Dean, Dr. (Col) Mahender Kumar, as well as the entire team at the placement cell, for their unwavering support throughout the duration of my dissertation.

I would like to express my gratitude towards my parents, specially my sister Nidhi and my friends (Ketki, Prarthita, Manjaree) for helping me out in my time of distress and opening a dam of positivity, and all the people associated with me for their kind co-operation and encouragement which helped me to crown this report.

I have the utmost respect for all the esteemed faculty members who have helped supervise and guide me along this road. Their knowledge, steadfast assistance, and presentation of crucial project information have all been essential to completing the allotted assignment effectively. I view this opportunity as a critical turning point in my professional development, and I am steadfast in my resolve to make the most use of the newly gained skills and information. I will actively work to implement the advice given to me in order to achieve my treasured professional goals.

CONTENTS

DECLARATION BY STUDENT	3
CERTIFICATE BY ORGANIZATION	4
CERTIFICATE BY INSTITUTION	5
PLAGIARISM REPORT	6
ACKNOWLEDGEMENT	7
TABLE OF FIGURES	9
TABLE FOR ABBREVIATION	9
ABSTRACT	10
1. INTRODUCTION	11
1.1 History and Background	11
1.2 Research Question.....	12
2. REVIEW OF LITERATURE	13
2.1 Challenges.....	13
2.2 Facilitators of digital health adoption	24
3. METHODOLOGY	30
3.1 Aim	30
3.2 Objectives.....	30
3.3 Material & Method.....	30
4. DISCUSSION	32
5. SUMMARY	35
6. RECOMMENDATIONS	38
7. REFERENCES	39
8. ANNEXURE – A	40

TABLE OF FIGURES

S. No	Content	Page No.
Fig 1	Existing approaches for health digital solution evaluation, current methodological gap, and emerging innovative pragmatic approaches to fill such gap	15

TABLE FOR ABBREVIATION

S.No	Abbreviation	Meaning
01	DHTs	Digital health technologies
02	ICTs	Information and communication technologies
03	IoT	Internet of Things
04	HIE	Health information exchange
05	EHR	Electronic health records
06	IRT	Individual-randomization trials
07	CRT	Cluster-randomization trials
08	MRT	Micro-randomization trials
09	GDPR	General Data Protection Regulation
10	AI	Artificial Intelligence

ABSTRACT

The demand for cutting-edge healthcare solutions and recent technological breakthroughs has both contributed to the substantial expansion and transformation of the digital health sector. This abstract gives a general overview of the digital health sector highlighting its gaps, challenges, unmet needs, and facilitators which exist in the digital health space.

Digital health makes healthcare services more accessible, especially in underserved or remote locations. Through digital platforms, patients may connect with healthcare providers and access services, removing any geographic restrictions. Digital health solutions also encourage disease prevention and early identification, allowing for prompt treatment and ultimately lower out of pocket expenditures.

The digital health sector, however, faces several difficulties. Strong protections and regulatory frameworks are required to secure patient information since data privacy and security issues provide substantial challenges. To ensure seamless data sharing and collaboration across healthcare providers, interoperability and standardisation of digital health systems remain essential. There are disparities in the uptake and accessibility of digital health, particularly among underprivileged communities or in areas with scarce resources, and these differences need to be addressed. Additionally, the reach and efficacy of digital health solutions may be constrained by the digital divide and discrepancies in access to technology, necessitating initiatives to close these gaps.

This study will help in understanding the gaps and difficulties in digital health sector, such as guaranteeing data security and privacy, adhering to regulations, assuring system interoperability, and tackling the digital divide that may prevent some populations from having access to these technologies.

This study will also help in identifying facilitators through which a multifaceted strategy incorporating technical breakthroughs, policy changes, moral concerns, and user-centered design can be developed to address these gaps and obstacles.

1. INTRODUCTION

1.1 History and Background

An interdisciplinary field known as "digital health" seeks to improve the effectiveness of diagnosis, patient monitoring, rehabilitation, management, prevention, as well as long-term care delivery. The emergence of digital health did not happen immediately. When health telematics first appeared in the 1970s, the history of digital health began. Health telematics provides the health-care systems with a great probability to improve health, health education, and follow-ups. As of now, health telematics sought to concentrate on the diseases and advancements in the treatment and diagnosis of disorders. One of the most well-known areas of digital health today is health telematics or telemedicine. (1)

The health care systems discovered that with the dawn of the 21st century and widespread usage of desktop computers and the Internet. (1)

“Digital health refers to the use of information and communications technologies in medicine and other health professions to manage illnesses and health risks and to promote wellness.”

The combination of technology with healthcare is known as the "digital health industry," and it aims to improve the provision of healthcare services and patient care which will eventually help in maximizing health outcomes. The extensive spectrum of digital solutions embraces Mobile apps, wearable technology, telemedicine, HIE, EHRs, remote monitoring systems, and applications for artificial intelligence (AI). (1)

Factors which have contributed to the growth of the digital health sector are:

- Technological developments which have made it feasible to gather, examine, and store enormous volumes of healthcare data. Due to this, EHR has been created, allowing medical professionals to access and share patient data more effectively.
- Second, the widespread use of cell phones and wearable technology has given people more authority to manage their own health. Wearable sensors and mobile health apps can detect vital signs, keep track of physical activity, and offer individualized health advice. These technologies support healthy behaviours, stimulate preventive care, and give patients the ability to actively control their own healthcare.
- Additionally, the arena of digital health has seen substantial growth in telemedicine. The use of telemedicine enables medical professionals to diagnose, treat, and monitor patients remotely through video consultations and digital communication tools. (1)

Several cutting-edge technologies, including but not limited to EHR (electronic health record), Blockchain, Electronic-health systems, and Internet of Things sensors, may help in managing the complexity that characterises healthcare procedures, which is kind of primary reasons for something common acceptance and uses of technology. With the help of these digital technologies, academics and professionals have had a tonne of occasions so as to enhance the effectiveness of patient participation in medical treatment, diagnostic-therapeutic procedures (such as surgical decision making, Using Artificial Intelligence for diagnostic process, and telemedicine devices for patient supervision, among others), and the redesigning to make it more useful for overall organizational as well as administrative processes for delivering economical care to the patients. (2)

“The digital health ecosystem is complicated, involving players and agencies from the general public, community and non-profit groups, health services, industry, and government, often with different and sometimes conflicting or competing interests and agendas to pursue.” (3)

Most of the telehealth and telemedicine technologies still fall short of addressing the needs of patients and healthcare practitioners, and their implementation frequently necessitates unseen labour that goes unrecognised. Even while there are a huge number of health and medical apps accessible, relatively few of them are really used. Some health and medical applications give false medical diagnoses or bad medical advice, which makes them potentially dangerous. (2)

This study will help in understanding the gaps and difficulties in digital health sector, such as guaranteeing data security and privacy, adhering to regulations, assuring system interoperability, and tackling the digital divide that may prevent some populations from having access to these technologies. (2)

1.4. RESEARCH QUESTION

- What are the disparities in the uptake and accessibility of digital health, particularly among underprivileged communities or in areas with scarce resources, and how can these differences be addressed?
- What are the obstacles to the widespread use of digital health care technologies and their integration into healthcare systems?
- What are the gaps in various electronic health records, digital health platforms, and healthcare providers, and how do these gaps impact the continuity and quality of patient care?

2.REVIEW OF LITERATURE

This portion of the study is divided into different sections to understand the relevance of the study. This section will include the following pressing points of the study-

2.1. Challenges

2.2. Facilitators of digital health adoptions

2.1. Challenges

Surveys and interviews are commonly used in the outset of digital health product growth to gather insights on usability, feasibility, and efficacy. These methods are cost-effective, efficient, and scalable, making them valuable tools for collecting user attitudes, experiences, and suitability feedback.

Although surveys, interviews, and usability testing are frequently employed in the development of digital health products, they may not always lead to peer-reviewed articles. Because their main objective is frequently to fabricate for internal use (like product development) or external uses (like case examples and related presentations), their evidence strength may be viewed as significantly weaker for peer-review publishing.

Designs such as IRTs, CRTs, MRTs, pre-post designs, and multi-site studies are commonly used to evaluate healthcare interventions in relation to digital health solutions.

IRTs are suitable for digital work which target individual users, like patient-level or clinician-level odds.

Whereas CRTs are best for those digital approaches that support group endeavor. CRTs are often used to minimize contamination between intervention and control groups and evaluate both the direct as well as indirect effects of an intervention.

MRTs are useful whenever the researchers aim to assess the effectiveness of specific components within an intervention.

Pre-post design is the most popular technique for assessing digital health solutions is the. It entails gathering control data in the pre-phase, carrying out the intervention with a subsequent "washout" phase, and gathering data on the efficacy of the remedy in the post-phase. This

design frequently calls for longer times, and it might not be the best for assessing medium- to long-term clinical outcomes or ongoing solution upgrades.

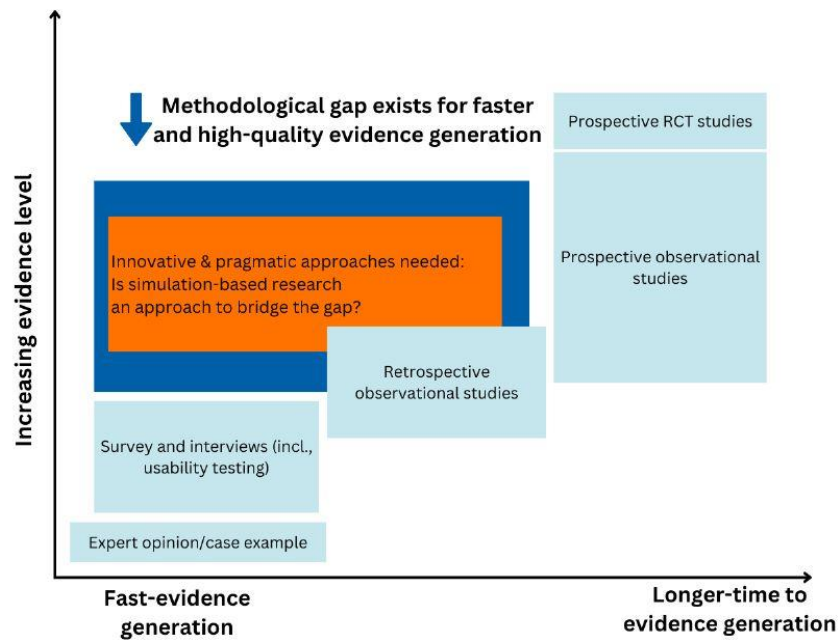
In multi-purpose RCTs, some of the sites are designated as control sites while the remaining sites are under study. It can be challenging to match up the control and experimental sites' important characteristics (such as workflow, patient characteristics) for this method. The biggest benefit is a shorter study period. The drawbacks include more setup work, higher costs, and difficulties finding matched locations.

Retrospective studies are a valuable approach for analyzing the already existing data, such as electronic medical records or patient charts, to generate hypotheses and explore associations, however; it has not been used extensively while evaluation the digital health solutions, primarily because of the relatively low adoption of those digital solutions in clinical practice and also the difficulties which are faced in gaining access to data, such as meeting GDPR compliance requirements.

The new pragmatic and innovation-based approach is simulation-based research in which computational simulation has been primarily applied for verification purposes, often using simulated outcomes which are depends on real or synthesized used cases prior involving users or professionals. System engineering takes a system simulation view with a techniques to model the cause of an interruption on a healthcare without disrupting the actual healthcare setting.

On the other hand, clinical simulation has historically been employed for teaching medical residents and has developed as a method to test digital solutions and systems with prototypical users in realistic situations. Traditional methods that call for using a digital solution in actual clinical practice can benefit from the addition of clinical simulation. Fast version upgrades are made possible by a balance between cost-effectiveness and cost-effectiveness provided by "near-live" clinical scenarios.

According to the author, clinical simulation can be used in conjunction with conventional design studies like cluster-level randomization, individual randomization, and micro-randomization to assess various digital solutions. For instance, research based on clinical simulation with a "micro-randomization" design can be a potent as well as a practical way to test multi-component digital solutions in their early product development process.



Existing approaches for digital health solution evaluation, current methodological gap, and emerging innovative pragmatic approaches to fill such gaps.

S.N o .	Author	Title of Study	Key Takeaways
01	Chaohui Guo, Hutan Ashrafian Et al. (4)	Challenges for the evaluation of digital health solutions—A call for innovative evidence generation approaches. (2020) (4)	• Since regulators base their evidence requirements on a product's purpose, a significant number of digital health procedures (such as governing techniques and wellbeing uses) are not subject to their control. As a result, it can be extremely difficult for end users to assess a naive solution's reliability and according to standards, including patients and providers (such as medical professionals and hospital administrators)
02	Amirreza Manteghinejad Et al. (1)	Challenges and opportunities of digital health in a post-COVID19 world (1)	• The absence of empirical -based digital gives the health-care systems use with data governance, and ethical issues are the main hinderance stopping the improvement of digital health care. • The COVID-19 pandemic has made clear that there is a requirement of constant review and the development of moral issues alongside the innovation field of digital healthcare, with data interchange. • Having the consent of an informed patient will be one of the major obstacles in transparency of data obtained health and the utilization of EHRs can be used to produce bits of proof, however all these data were collected by convenience sampling. As a result, this issue influences the standard of the data from studies on these technologies. Background factors including age, sex, socioeconomic position, and geographic

			distribution must be documented and compared between the groups to answer this problem. • Governments having also trouble with data management. 50% of countries have proper and strict privacy laws to protect data, even though technology has reduced costs which are brought to digitalization by the majority of governments. Therefore, it is crucial that governments establish laws and guidelines for data stewardship. • The ethical dilemma with medical digitization is identically significant and the other issue is user consent. Users should be informed about data gathering. Although most apps request this permission, users frequently ignore this request, and most users merely click the "I agree" button at first without reading the applications' conditions of use.
--	--	--	--

03	Rocco Palumbo Et al. (5)	Addressing health literacy in the digital domain: insights from a literature review (5)	• Patients who have low levels of digital health literacy may have trouble determining the validity of any information and, as a result, may be incompetent to use it effectively for health promotion and risk reduction. • The use of ICTs with digital tools to procure timely and pertinent info regarding health-related concerns, such as news and data which are available on social media, is expected to pose challenges for persons with inadequate digital health literacy. • People with inadequate digital health literacy are unable to properly adhere to the recommendations and instructions given by healthcare professionals because of the inability to use ICTs and digital platforms to support both individual and societal well-being.
04	Ramya Sita Palacholla, MD, MPH Et al. (6)	Provider- and Patient-Related Barriers to and Facilitators of Digital Health Technology Adoption for Hypertension Management: Scoping Review. (2019) (6)	Barriers in adapting ‘Digital Health Provider’ Factors • “Sparseness of Integration with Clinical Workflow “ According to some research, a significant obstacle to the adoption of DHT is the absence of technological integration with clinical workflow. Numerous research emphasized the dearth of resources for care teams which are needed to successfully deploy DHTs and carry out extra duties. Several providers claimed that adopting DHTs was difficult for them since there were too many additional chores. • Absence of Technology validation

			Some service providers identified data accuracy issues as a main barrier to deploying home blood pressure monitors more widely. Lack of proof that DHTs improved patient outcomes was another deterrent to provider adoption. • Data Privacy and Security Concerns Patient data privacy and security is major concern. • Scarcity of Technology Usability and its Support The complexity of technologies was another barrier that was frequently mentioned in literature. The reasons for ending interaction with DHTs were listed as being frequent technical problems and insufficient onsite help to fix them. Additionally, because of the learning curve linked with new DHTs, it was challenging for practitioners to reconcile the utilization of a new system with maintaining their regular clinical schedule. • Lack of Organizational Support Implementation of new DHTs was delayed by organizational causes like a lack of leadership support for incorporating technology into practice and budgetary restrictions. Hospital finances were too tight to assemble the funds required to integrate DHTs into the clinical practice process. • Increased Patient Anxiety According to one study, doctors were worried that patients would become more agitated if they continuously checked their blood pressure readings
--	--	--	--

			and thought that providing patients with too much data might be more detrimental than helpful. Patient Factors • Absence of Technology Usability and its Support Patients were not able to use DHTs due to high-tech problems such as connectivity, password access, and usability. Patients frequently favored DHTs that required less time to use and were simple to use, regardless of their level of technological expertise. Adopting DHTs into daily life was difficult for patients with chronic illnesses, poor dexterity, and reduced vision. • Problem with the interference patient provider relationship Patients are concerned about how using DHTs will affect their present face-to-face interactions with healthcare professionals. Another obstacle that patients encountered when using DHTs with a physician-facing portal was the absence of prompt provider's feedback. DHTs were sometimes seen as a hindrance to patients' sentiments of freedom because they required them to share data with clinicians even though they might not have wanted to. • Increase in Patient Anxiety Some of the patients undergo anxiety after using DHTs. This problem or complexity in checking their BP frequently and not able to directly contact
--	--	--	---

05	Soutongnoma Safiata Kaboré Et al. (7)	Barriers and facilitators for the sustainability of digital health interventions in low and middle-income countries: A systematic review. (2022) (7)	their provider for timely feedback. • Data Privacy and Security Concerns Patients were at ease with only themselves and their physicians having access to their health information. Patients were uncomfortable with the possibility of a third party seeing their data and anxious and uncomfortable about the privacy of data provided via DHTs. • Lack of technology validation In some of the studies, patients have raised questions about the precision of the accuracy and data registered (BP readings) by DHTs. • Price of the equipment for Digital Health Another hindrance to adoption was the price of the technology used for digital health. Some patients also voiced worry about being held responsible for the expense of equipment damage. • The design of project and its implementation facto, System usability problems were the most often mentioned impediment, especially in lower-level healthcare facilities. Barriers to internet access included expense, instability, and unavailability. Other stated obstacles were sporadic access to computers at work and unreliable electricity. Additional obstacles included the extra time needed to use the system, difficulties with hybrid paper and digital
----	---------------------------------------	--	--

			health interventions (DHIs) systems, and the belief that there were no real advantages to using electronic systems. Barriers included limited availability and accessibility of medical equipment as well as inadequate infrastructure and expertise to scale up efficiently. • The problem at the training stage included capacity-building issues such as insufficient training data, high staff attrition rate in private facilities, and low levels of education and literacy rates. • In organizational settings, merging DHIs with extant programs and services is crucial. However, related challenges at the national level and frequent changes in health management structure pose barriers to successful implementation. • In the larger community setting, socioeconomic concerns including scarce resources, added expenses, abuse, and corruption contribute to hurdles. The creation of free and open-source platforms, the cost-effectiveness of telecommunications services, the accessibility of financial resources, funding methods, and cost-effectiveness are some facilitators that can assist remove these obstacles. The availability of legislation and policy, the involvement of the government and stakeholders, and the resolving of personal data privacy issues are all considered
--	--	--	---

			developer at the political consideration level. Challenges with policies and ineffectiveness of policies were also noted. Human resource limitations, such as frequent employee turnover in private facilities, a lack of specialization, and a lack of community technology integration are among the variables that affect the extent of community participation. Participation in the community is also hampered by hurdles linked to age, language, myths, and misconceptions. Usability issues include obstacles including limited data use for planning purposes, a bad information culture, a distaste for technology, and a lack of a pharmacovigilance reporting culture. A behavioral barrier that restricts the use of telehealth is the fear of stigma associated with disabilities.
--	--	--	---

2.2. Facilitators of digital health adoptions

S.No.	Author	Title of Study	Key Takeaways
01	Anthony Duffy Et al. (8)	Examining Challenges to the Incorporation of End Users in the Design of Digital Health Interventions: Protocol for a Systematic Review. (2021) (8)	• In order to promote digital health in the future, it is critical to lessen the polarization between digital and health cultures. As the area develops, multidisciplinary approaches must become transdisciplinary ones that cut across industry borders and seamlessly combine digital and health. While health professionals would profit from knowing the value of proximal user research and quick iteration, digital experts should work to better understand distal health outcomes. • There have been many different design methodologies investigated, each presenting a different viewpoint on how to create purposeful design in digital health. The primary stakeholder should be the user, person, or patient, but while this is crucial, the bigger problem is to foster a truly transdisciplinary environment where a culture of digital health can develop while reducing conflict between conflicting interests. • This can be accomplished by demonstrating a tangible value proposition that highlights quicker, higher-quality, more effective, and user-empowered solutions. All stakeholders may become more engaged because of such a proposal. The usefulness and cost-effectiveness of each design strategy in practical contexts need more investigation.

02	Ramya Sita Palacholla, MD, MPH, Et al. (6)	Provider- and Patient-Related Barriers to and Facilitators of Digital Health Technology Adoption for Hypertension Management : Scoping Review. (2019) (6)	Developers of DHP Adoption Factors: • Clinical Workflow with ease of Integration The results imply that a new technology's integration into an existing provider workflow has a significant impact on DHT adoption. Having a care team to assist DHT deployment as part of the clinical process, according to providers, was a key adoption facilitator. According to several research, physicians may successfully employ DHTs if the data they provided were useful and could be quickly incorporated into already-established clinical procedures to enable prompt intervention to enhance patient outcomes. Providers were drawn to DHTs that automatically alerted them when a medication or dosage needed to be changed because they made regular activities go more quickly. • Patient Health Outcomes Improved One of the most important variables in the adoption of DHTs was the providers' perceptions if the technology can improve clinical outcomes or promoted patient self-management. Clinicians have occasionally believed that DHTs that have been proven effective in pilot and RCT studies are preferable. The professionals also emphasized the value of patients actively participating in their own health. Finally, DHTs provide a quicker response to high BP levels and assisted physicians in preventing extreme health outcomes in their patients by immediately responding to fluctuation in BP levels.
----	--	---	---

		• Technology Usability and Technical Support According to certain studies, system simplicity and usability are important to suppliers. Additionally, DHTs that required little training were favored by physicians. When incorporating DHTs into their therapeutic process, providers valued receiving enough technological support. • The Financial Factors It has been found that incentives like rewarding physicians for using DHTs at regular clinical practice and proven to be a cost saving. So, its implementation will help in huge cost saving. • Leadership and Organizational Support Since it was frequently challenging for clinicians adopt DHT without support from organization and management, especially in case of cost and budget, it was suggested that an organizational culture of technology adaptation combined with the presence of physician compatibility was a factor affecting the adoption of DHTs. Patient Factors • “Technology Usability and Technical Support Patient engagement” It was facilitated by DHTs that were simple to use and offered prompt technical help. Patients who were older or had less tech skills said that technical support was a facilitator. Patients preferred treatments that were simple to incorporate into their everyday schedules. When interventions were culturally appropriate for
--	--	--

			target populations, they were more likely to be adopted. - Improved Patient-Provider Communication “Improved communication with providers was a facilitator of adoption for patients. Some patients reported that DHTs enabled direct contact with their providers to share their health data and receive feedback. Data sharing via DHTs helped patients better understand their care plans and promoted shared decision making. DHTs improved visit preparation and accuracy of patient-provided information.” - Development in Self-Management and Patient Experience Patients were more inclined to use DHTs that increased their desire to take control of their own health. Patients claimed that having access to and viewing their health information on their own device motivated them to take a more active role in their health. Several studies found that utilizing DHTs to control hypertension led to higher patient satisfaction. Some individuals discovered that utilizing DHTs to track their blood pressure readings reduced their worry linked to their health. - Reduction of Office Visits Research suggested that one factor encouraging patients to use DHT was the potential ability to avoid having to travel to the doctor's office. - Positive effects on higher-quality healthcare delivery were highlighted from the perspective of the facilitator. DHIs' simplicity of use and acceptance,
03	Soutongno ma Safiata Kaboré Et al. (7)	Barriers and facilitators for the sustainability of	

		digital health interventions in low and middle-income countries: A systematic review. (2022) (7)	accessibility of resources, particularly computers, and viability were also emphasized. DHIs designed to meet the demand of the healthcare system, service quality and availability, accessibility of phones, straightforward and safe technologies/interventions, maintenance, phone features, and the perception of use of functional infrastructure were additional facilitators. • Facilitators at the training level included continuous training, upgrading, and education of healthcare staff, supervision, performance review meetings, and empowerment of healthcare staff. Other facilitators included willingness to support, availability of case-related resources and mHealth usage guidelines, documentation, awareness building, significant knowledge gains, and the available for clarifying of tools. • Organizational facilitators include prioritization of DHIs at the national level, government and stakeholder support, availability of sustainability plans, and clear staff job descriptions. • The availability of partnership and support, perceived ease of use, familiarity with DHIs in urban areas, social acceptance, positive attitudes, self-motivation, age and gender considerations, and positive provider-patient/community relationships are among the factors that have been identified as
--	--	--	---

			facilitators across the studies. DHIs that are triggered and chosen based on community needs, end-user participation in design and execution, and ongoing end-user feedback are all cited as facilitators for sustainability. A successful implementation is also aided by staff competence and motivation, networks of cooperation with practicing partners, experience and comfort with the system, increased satisfaction, comfort, privacy, and client trust, as well as favorable participant perceptions of DHIs.
--	--	--	--

3. METHODOLOGY

3.1 Aim

To study the gaps and unmet needs of the population in the digital health space.

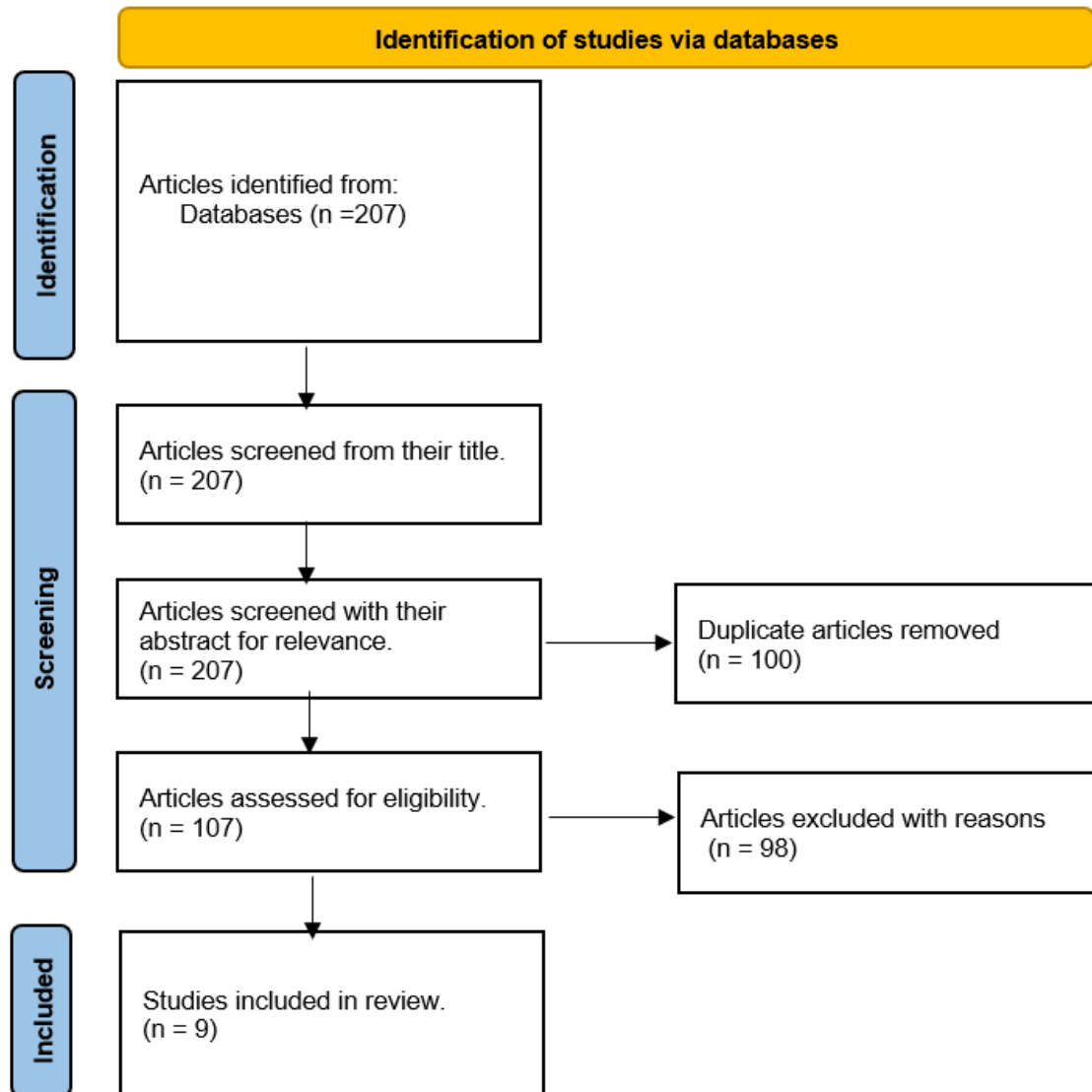
3.3 Objectives

- Identify existing challenges and areas of improvement in the digital health landscape which consists of various stakeholders in the digital health space, including patients, healthcare providers, policymakers, and technology developers.
- To assess how the identified gaps and unmet needs impact the healthcare delivery of services on patient outcomes, healthcare costs, efficiency, access to care, and overall quality of healthcare delivery.
- To assess disparities and address the digital divide among underserved populations or in regions with limited resources.

3.4Material & Method

- **SOURCES** - Literature Databases like PubMed, google scholar, science direct, JMIR Publications, npj Digital medicine, Emerald Insight, Research gate.
- **YEARS**- 2017-2023
- **DURATION OF STUDY** – This review was conducted during the three months period. (February – May 2023).

▪ **DATA COLLECTION PROCEDURE –**



▪ **ETHICAL CONSIDERATIONS –**

- As this is a narrative reviewed it doesn't harm anyone in particular and the existing qualitative data aligns with the purpose for which it was originally collected. It respects the intellectual property rights and permissions associated with the data. Proper acknowledgement of the original authors and studies is provided.
- The findings are accurate and transparent, giving due credit to the original data sources. Care is taken to present the results in a manner that protects the privacy and confidentiality of the participants.

4. DISCUSSION

The research on the digital health space has identified several gaps and challenges that need to be addressed with facilitators. These include:

4.1. CHALLENGES

- Use and access to electronic medical records and patient portals is limited due to interoperability challenges, privacy concerns, and variances in implementation across various healthcare systems. It is still a challenge to make sure that healthcare consumers and providers have seamless access to electronic medical data and patient portals.
- Limitations of Telemedicine and Telehealth Technologies: Even while telemedicine and telehealth technologies have increased access to medical services, they still have difficulty addressing the various needs of patients and medical professionals. Their effectiveness and uptake may be impacted by technical issues, connectivity concerns, and a lack of interface with current healthcare systems.
- There is a limited adoption of health and medical apps as only a small portion of the numerous health and medical apps available are used. This demonstrates the necessity of strengthening user interaction, addressing usability concerns, and improving app design to encourage widespread adoption.
- Accuracy and safety of health and medical Apps is still controversial as some health and medical applications have been discovered to give false diagnosis or harmful medical advice, making them potentially deadly. To safeguard users' health and preserve confidence in digital health technologies, it is essential to guarantee the reliability and security of these apps.
- Complex and fragmented digital health ecosystem includes several parties with various, occasionally competing interests and goals. To solve the complicated issues and guarantee the availability and effectiveness of digital health, cooperation, and coordination across these stakeholders—including the general public, community and not-for-profit organisations, health services, industry, and government—is crucial.

Therefore, collaboration between researchers, policymakers, healthcare practitioners, industry stakeholders, and end users is necessary to address these research gaps and issues in digital health. Prioritising research efforts, making infrastructure investments, encouraging interdisciplinary collaboration, and including end users in the development and assessment of digital health solutions are crucial. The potential of digital health to revolutionise patient care,

boost population health, and improve patient outcomes may be fully realised by filling these gaps.

4.2. FACILITATORS

A multifaceted strategy incorporating technical breakthroughs, policy changes, moral concerns, and user-centered design is needed to address these gaps and obstacles. In order to build a sustainable and inclusive digital health ecosystem that prioritises patient outcomes, data protection, and accessibility, it is crucial for researchers, industry professionals, policymakers, and healthcare providers to work together.

Interventions to address limited digital health literacy:

- Users (i.e., patients and unpaid carers) should take part in specialised educational activities that aim to give them the fundamental knowledge and abilities to use digital resources and ICTs to become more aware of their health conditions and to voluntarily co-design and co-deliver care.
- Education programmes and information sources should focus on raising knowledge of the health difficulties faced, rather than promoting self-management of treatment, enabling patients and unofficial carers to make educated decisions to enhance their health state.
- Health care professionals should be given training activities to improve their functional skills, with the main goals being to improve their ability to communicate succinctly and clearly to people through digital channels, to increase awareness of patients' information needs, and to make the best use of the available digital tools to empower and engage people in value co-creation.
- To improve patients' and informal carers' abilities to use the digital health care system, relational competencies should be developed. This will also encourage healthcare professionals to co-produce health services with users. Relationship-building abilities are essential to Take full advantage of technical improvements that allow for remote consultations and allow people to contact the providers of care even if they are unable to do so physically. This will help patients, informal carers, and health care professionals.
- Specific actions should be taken to increase patients' and informal carers' crucial digital health literacy abilities, enhancing their capacity to distinguish between the various sources of information they might get online. Particularly, IT technologies and systems (such as specialised websites, applications, and social media) can greatly improve social

support information networks for people with low health literacy. Gamification is a crucial strategy for teaching individuals how to acquire the necessary critical thinking abilities to deal with the complexity of health-related issues and to improve their competency in determining the veracity of health information.

- Simulation-based research can make it possible to produce more reliable, affordable, and timely evidence. By considering such ways, end-users will encourage developers to engage in research activities as opposed to being deterred by the difficulty, expense, and length of traditional procedures.
- The functional, relational, and critical abilities of patients, unpaid carers, and healthcare professionals make up the dynamic and systemic bundle of competencies known as digital health literacy. It creates the framework for a holistic and people-centered approach to care in the digital world, which can be realised by encouraging co-creating interactions between patients, informal carers, and healthcare professionals.
- Identification of the overarching pain points in digital health through the triangulation of the common issues that permeate all design strategies. A thorough analysis of the main obstacles to end users' inclusion in DHI design would be helpful in achieving this goal.
- User studies that show teamwork with business partners to include different design workflows into agile workflows would show practical application in health care app development. By offering a value proposition and real-world analysis, this will aid in proof of concept. Due to real-time industry restrictions, it will also examine and address concerns of viability and scalability.
- Case studies where digital specialists spend time in medical settings to comprehend what efficacy and validation mean in a medical setting. To improve our understanding of meaningful design and user validation, a study of health professionals who go beyond consulting and actively participate in agile development cycles, from conception to product delivery, is required.

5. SUMMARY/CONCLUSION

- **Interoperability and Data Integration:** The lack of interoperability across various healthcare systems, devices, and applications is a significant issue in the digital health sector. The efficient and coordinated delivery of care depends on the seamless transmission of data between platforms and systems. To meet this problem, it is crucial to ensure standardised data formats and protocols and to support interoperability initiatives.
- **Privacy and security:** Sensitive personal health data is collected, stored, and sent through digital health. It is crucial to ensure the security and privacy of this data. Unauthorised access, data breaches, and the potential exploitation of health data are all causes for concern. To address these, it is essential to create strong security measures, follow privacy laws, and educate consumers about the value of data protection.
- **User Acceptance and Engagement:** Despite the widespread usage of digital health technologies, these issues continue to be major obstacles. Digital health solutions may provide challenges for many people, especially older folks and those with low levels of digital literacy. The adoption and engagement with digital health technology can be increased by resolving usability, accessibility, and user-centered design challenges.
- **Evidence and evaluation:** As the field of digital health develops quickly, robust research is required to determine the efficacy, safety, and cost-effectiveness of different digital health initiatives. More study is required to fully comprehend the influence of numerous digital health technologies on patient satisfaction, health outcomes, and healthcare delivery because the evidence base for these technologies is still developing.
- **Regulation and policy:** The regulatory environment in which the digital health industry operates is complicated. As technology develops, regulatory frameworks must keep up to ensure patient safety, data privacy, and ethical issues. To solve

the regulatory problems in this area, it is crucial to create clear rules, standards, and regulations for the creation, assessment, and use of digital health solutions.

- Health disparities: There is a chance that current health disparities will get worse as a result of digital health technologies. Different populations do not all have equal access to technology, internet connectivity, and digital literacy, which could result in differences in who can use and benefit from digital health solutions. Efforts should be taken to close the digital divide and guarantee that all people, regardless of their circumstances, can access and benefit from digital health interventions.

Limitations:

- Many technologies and interventions used in the digital health sector are still relatively new. As a result, there may be insufficient long-term investigations and thorough evaluations, which might result in a weak evidence base. Therefore, it was challenging to evaluate the long-term efficacy, safety, and cost-effectiveness of digital health interventions due to the little body of evidence.
- Results may not fully generalise to different people, contexts, or technologies as a result of my lack of time to read through all the studies.
- Data privacy, security, and informed consent are all important ethical issues in digital health research. Therefore, this research may not give specific information on the ethical practises used.

6. RECOMMENDATIONS

“Digital intervention is a knotty change. It requires all stakeholders to work together as an ecosystem to enable quality care and well-being of the citizens.” (9)

Steps taken to bridge the gaps present in digital space industry:

- The digitalization of health data in India is one of the main goals of NDHM. To ensure adequate long-term care, this project is expected to require patients to securely retain, access, and share their medical records with other healthcare stakeholders. These records may include prescriptions, diagnostic results, and discharge summaries.
- All parties (physicians, patients, diagnostic labs, private and public hospitals, legislators, state and federal governments, pharmacies, insurance companies) must collaborate to develop a national level digital health ecosystem.
- Given that between 50% and 65% of digital deployments fail, it is vital to assess how prepared the various stakeholder entities are for success. To avoid ambiguity, promptness is defined as the ability of the stakeholder group to easily embrace the digitization of health data initiative with the least defiance from the stakeholders and related systems for its effective and sustainable usage to accomplish the specified results. (9)

There are various factors which help in building a digital health ecosystem with digital readiness but the three factors which play a critical role are — integration, infrastructure, and intent.

1. The other two readiness factors are driven by Intent and that is why it is the most important. Every stakeholder needs to be convinced of the advantages of digitization because it is both complicated and expensive. Every stakeholder organisation should first comprehend the real purpose of creating an ecosystem for digital health. Digitalizing medical procedures or records entirely for the sake of digitalization would not produce long-term gains. This component could be driven through a clearly articulated digital strategy. Second, without succumbing to a narrow competitive perspective, every stakeholder group must be able to encompass the big picture i.e., at the national level. Investments are driven by intent, and strengthening this aspect at the service provider level would entail going beyond immediate financial gains. Third, the government and other players in the healthcare ecosystem must work collaborate to make this intent into reality. Regulations and policy direction should be friendly to the users which will encourage these stakeholders to maintain their motivation and fascination.

2. Infrastructure: There are various infrastructural aspects that should be considered while developing a digital health ecosystem. The information, hardware, and software infrastructure of technology comes first. Assuming the government budget contains sufficient financial resources to support the digital transformation, it is necessary to set clear rules regarding who owns what technological infrastructure and who is responsible for it. Second, it's crucial to consider whether to integrate clinical decision aid tools so that the doctors won't have to handle data redundancy considering the shortage of doctors and other healthcare workers. Third, providing confidentiality and privacy of the health records is a crucial component of infrastructure readiness.

3. Integration: The integration of multiple health stakeholder groups and related interfaces is dealt with in this aspect. It is important to realise that creating a digital ecosystem does not mean just digitising a single hospital or group of hospitals' patient records, it entails more than that such as other crucial stakeholders including insurance companies, diagnostic labs, pharmacies, and other organisations have significant responsibilities to offer. The capacity to integrate different systems, cultures, business processes, and people is what brings them all under a single digital roof.

7. References

1. Manteghinejad A, Javanmard SH. Challenges and opportunities of digital health in a post-COVID19 world. 2021.
2. Mas FD, Massaro M, Rippa P, Secundo G. The challenges of digital transformation in healthcare: An interdisciplinary literature review, framework, and future research agenda. 2023.
3. Lupton D. Digital health now and in the future: Findings from a participatory design stakeholder workshop. 2017.
4. Chaohui Guo HASGGFCG&MP. Challenges for the evaluation of digital health solutions—A call for innovative evidence generation approaches. 2020.
5. Rocco Palumbo CNPA. Addressing health literacy in the digital domain: insights from a liertaure reveiw. 2021.
6. Ramya Sita Palacholla MMNFMACMSAMMKMMJFPCKMLMKJMM. Provider- and Patient-Related Barriers to and Facilitators of Digital Health Technology Adoption for Hypertension Management: Scoping Review. .
7. al SSKe. Barriers and facilitators for the sustainability of digital health interventions in low and middle-income countries: A systematic review. 2022.
8. al ADe. Examining Challenges to the Incorporation of End Users in the Design of Digital Health Interventions: Protocol for a Systematic Review. 2022.
9. Need for national digital readiness within the Indian healthcare system. 2021.

DEEPTI KIRAN _DISSERTATION

ORIGINALITY REPORT

9% SIMILARITY INDEX	8% INTERNET SOURCES	5% PUBLICATIONS	2% STUDENT PAPERS
-------------------------------	-------------------------------	---------------------------	-----------------------------

PRIMARY SOURCES

1	pdfs.semanticscholar.org Internet Source	2%
2	cardio.jmir.org Internet Source	2%
3	api.forbesindia.com Internet Source	1%
4	journals.sagepub.com Internet Source	1%
5	Rocco Palumbo, Capolupo Nicola, Paola Adinolfi. "Addressing health literacy in the digital domain: insights from a literature review", Kybernetes, 2021 Publication	1%
6	www.jmir.org Internet Source	<1%
7	www.nature.com Internet Source	<1%
8	www.ncbi.nlm.nih.gov Internet Source	<1%

9	Submitted to University of Kent at Canterbury Student Paper	<1%
10	Submitted to University of Central Lancashire Student Paper	<1%
11	www.frontiersin.org Internet Source	<1%
12	academic.oup.com Internet Source	<1%
13	www.mdpi.com Internet Source	<1%

Exclude quotes ☒ On
Exclude bibliography ☒ On

Exclude matches ☐ Off