Journal of Health Research
eISSN 2586-940X

Volume 37 | Issue 3 Article 1

2023

The Impact of eHealth Applications In Healthcare Intervention: A Systematic Review

Fadly Syah Arsad
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Sharifah Saffinas Syed Soffian
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Puteri Sofia Nadira Megat Kamaruddin
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Nor Rumaizah Nordin
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Mohd Hafiz Baharudin
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Ummi Mirza Baharudin
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Mohd Rohaizat Hassan
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Azmawati Mohamed Nawi
Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

Norfazilah Ahmad

Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur, Malaysia

REVIEW

The Impact of eHealth Applications in Healthcare Intervention: A Systematic Review

Fadly S. Arsad, Sharifah S. Syed Soffian, Puteri S. Nadira Megat Kamaruddin, Nor R. Nordin, Mohd H. Baharudin, Ummi M. Baharudin, Mohd R. Hassan, Azmawati M. Nawi, Norfazilah Ahmad*

Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur 56000, Malaysia

Abstract

Background: **Electronic health (eHealth) is the application of information communication technologies across all ranges of functions involved in the practice and delivery of health care. The rapid development of informatics and the Internet do not parallel eHealth interventions, and the knowledge gap needs to be explored. We aimed to identify and review the impact of eHealth applications (apps) on healthcare interventions.**

Method: **We used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) review protocol and formulated the research question based on PICO (Population or Problem, Interest, Context). The selected databases were Ovid, Web Of Science, PubMed, SAGE and EBSCOhost. Following thorough identification, screening and eligibility evaluation, a total of 10 articles were included in this study. The articles were ranked according to quality with the MMAT (Mixed Method Appraisal Tool).**

Results: **The results were organized according to the benefits and issues among patients and health care workers. Standardized eHealth improved patient health literacy and aided disease self-management. eHealth provided cost-effective measures via online consultation, improved awareness and motivation to comply with treatment and with declaring clinical symptoms. Low socioeconomic status impeded the implementation of eHealth among patients due to the expensive equipment needed to access eHealth material. User-oriented content in eHealth apps was essential for good acceptance among patients.**

Conclusion: **Good implementation of eHealth is an effective alternative for addressing the healthcare needs of society through empowerment.**

Keywords: eHealth literacy, Telemedicine, Delivery of health care, Information technology, Patient

1. Introduction

Electronic health (eHealth) is defined as the use of information and communication technologies (ICT) in the provision of health care services. eHealth is the application of ICT across all ranges of functions involved in the practice and delivery of health care [1,2]. eHealth can be used to adapt health messages to the patient's personal situation and might therefore contribute significantly to the development of tailored message strategies. In this urbanization era, non-communicable diseases (NCDs) and mental health disorders (MHDs) have become widespread, and are major causes of global morbidity and mortality, with NCDs accounting for 65% of all deaths [3]. NCDs and MHDs present a unique challenge to healthcare systems, as they are strongly linked to environmental and behavioural risk factors that lead to their requiring treatment beyond medicines; thus, there is a need to explore and improve efficient models of health care services delivery [3]. Health care should be cost-effective, widely acceptable and easily accessible at all times, wherein eHealth has high potential for achieving this objective.

Received 18 June 2021; revised 4 October 2021; accepted 18 October 2021.
Available online 31 August 2022

* Corresponding author.
E-mail address: norfazilah@ppukm.ukm.edu.my (N. Ahmad).

https://doi.org/10.56808/2586-940X.1020

One very common form of eHealth is patient self-care and education, and it includes interactive websites and medical devices for self-monitoring [4]. Along with adapting to eHealth, patients are becoming increasingly involved in their own health care process. This also seems to be a welcome trend from the patient side, as more people are interested in their own health and proactively seeking health information on the Internet. With the potential of being readily available online and on handheld devices such as smartphones and tablets, eHealth interventions can be used for promoting health literacy. The field of eHealth is promising in that it can support and enable health behaviour changes and aid disease prevention and management [5]. The management of a chronic disease should be personalized, as the patient is ultimately responsible for the success of the intervention [6].

Creating eHealth interventions for improving health literacy will aid the extended duration and quality of life of patients [7]. Moreover, the advantage of eHealth interventions is that they can provide interactive and responsive programs [6]. These interventions can provide effective data and information provision and retrieval. The advantages of tailored message strategies can contribute to the incorporation of interactive and continued self-monitoring, feedback and information exchange, which play an increasingly important role in changing patient behaviour [7].

The recent surge of technology capability has led to the rapid evolution and proliferation of health information. However, it does not parallel the evaluation of health promotion research and methodologies [8]. In addition, as the level of penetration was achieved as a personal desire. The increasing number of people with free access to the Internet has led to ineffective dissemination of eHealth interventions [9].

To promote continued research on the impact of eHealth applications (apps) that improve health interventions in patients, it is important to continually and empirically evaluate the research literature to better understand what is known, what remains unknown and any future trends in the field. Further, the observations and implications for future study in the area would be clarified. To address this knowledge gap, we identified and reviewed the impact of eHealth apps on healthcare interventions.

2. Methodology

The study was guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) review protocol, designed specifically for systematic reviews and meta-analyses [10]. The PRISMA guidelines are aimed at prompting researchers to source the correct information with an accurate level of detail. Based on the protocol, we started this systematic literature review by formulating the appropriate research question.

2.1. Formulation of the research question

The research question was formulated based on PICO, a tool based on three main concepts: Population or Problem, Interest and Context [11] and that aided the development of a suitable research question for the review. Based on PICO, the three main aspects in this review were patients (Population), eHealth apps (Interest) and impact on healthcare intervention (Context), and guided the formulation of the main research question: 'What are the impacts of eHealth apps on healthcare intervention?'

2.2. Systematic search strategy

The three main processes in the systematic search strategy were identification, screening and evaluation of eligibility (Fig. 1).

2.2.1. Identification

We searched for any synonyms, Medical Subject Headings (MeSH) terms, related terms and variations of the following main keywords: eHealth, healthcare intervention, impact. The process provided greater coverage for discovering related articles in the selected databases (Ovid, Web of Science, PubMed, SAGE, EBSCOhost) during the literature search (S1 Appendix). The databases had the following distinct features: large collection of literature, high-quality articles, advanced search functions. Literature searching was performed in late December 2020 until early January 2021. The initial search returned 5626 articles, of which 97 duplicate articles were removed, leaving 5529 articles.

2.2.2. Screening

We screened the 5529 articles with the sorting function from each database. The inclusion criteria were: full empirical journal article, published in English, published within 2010–2020, observational and international study. The 10-year period was chosen because we wanted to capture the recent eHealth concept and technology parallel with the advancement of technology in that period. We excluded 5506 articles due to irrelevant population, intervention or outcome, and also excluded systematic reviews, animal studies, conference abstracts and in vivo or in vitro studies.

2.2.3. Eligibility

We chose articles that fulfilled the study objective by reading the article titles and abstracts. In the end,

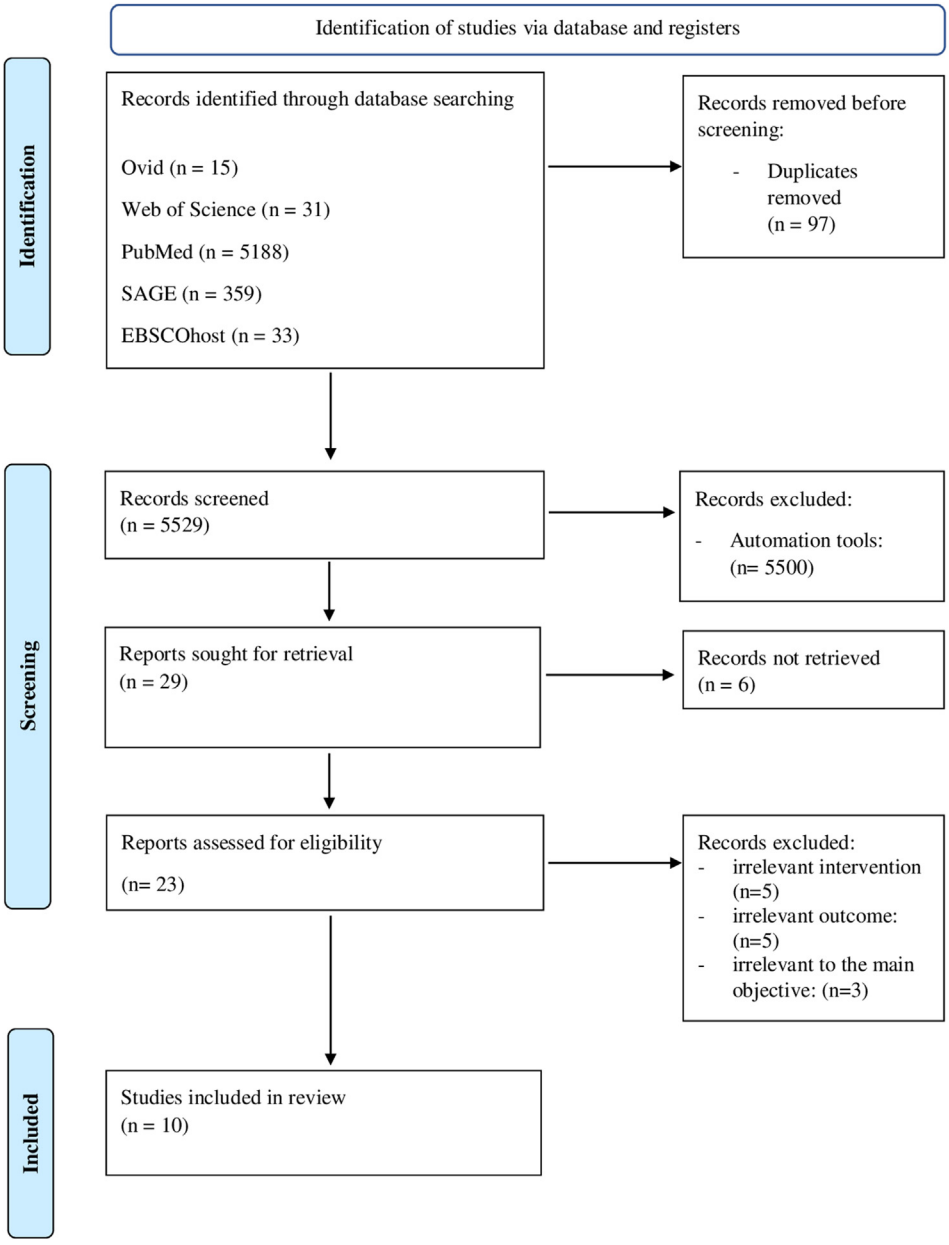

Fig. 1. The PRISMA flow diagram.

we manually sorted 23 articles that satisfied the study criteria, e.g. interest in eHealth and impact on healthcare interventions. We excluded studies not related to the study interest and intended outcome. Accordingly, 13 articles were excluded based on irrelevant intervention, outcome and lack of relevance to the main study objective. Eventually, only 10 articles were included in this study (Fig. 1).

2.3. Data extraction and analysis

We used thematic analysis in this systematic review because it is considered appropriate in synthesizing and integrating mixed research design [12]. Thematic analysis is also a descriptive analysis that allows data to be merged with other data analysis techniques [13]. We read the 10 included articles in detail, especially the abstract, methods, results, and discussion sections. Then, we extracted the data based on whether the study was able to answer its research questions, and then simplified the findings before performing the thematic analysis (Table 1). To generate relevant themes, we used Braun & Clarke's six-phase framework that consist of familiarization of data, codes generation, search for themes, review themes, define themes and write

Table 1. Compilation.

AUTHOR	COUNTRY	EHEALTH INTERVENTION TYPE	STUDY DESCRIPTION	TYPE OF DISEASE	SETTING	OUTCOME
1.Saleema Gulzar et al., 2013	Pakistan	Examine the impact on using eHealth on their services among nurses in Pakistan	A qualitative study, using semi-structured inter-view 9 participants	Comprises all primary healthcare and secondary level diseases	Primary Hospitals	**1. Before using eHealth** • logistic problem (far away from patient's house-difficult to communicate • remote patient has lack access for health info and treatment advices **2. Benefit eHealth** • nurses use eHealth to discuss complicated cases to specialist • better communication among healthcare workers (HCW) and communities • saves time and cost to patients n staff **3. Challenges using eHealth** • lack of electricity in Pakistan • lack of internet knowledge • connectivity issues
2. Sanne Lub-berding et al., 2014	Amsterdam	Examine the impact of using eHealth tools on quality of life among cancer patients	A qualitative study, using interview 30 respondents	Head and neck cancer patient and breast ca patient	Outpatient setting	**1. Benefit using eHealth** • early identification of problems (symptoms etc) • avoid wrong information − reduced anxiety • shared experience of the cancer survivors − increase motivation **2. Challenges using eHealth** • not being well informed regarding possible post treatment symptom • some patient has emotional barrier − afraid to inform their care provider regarding their new symptoms post treatment • physical barrier- patient didn't want to bother their care provider regarding their issues (too short consultation time
3. Klocek et al., 2019	Czech Republic	Evaluate the use of information communication technology (ICT) and eHealth tools by Czech GPs, to elucidate their motivation and barriers to the adoption of eHealth technologies.	Cross-sectional, mixed-design survey study, administered on-line 196 participants, 153 completed the survey.	No specific disease, general	General practice (from GP perspective)	**1. Challenges using eHealth** • on the side of General Practitioners (GPs) (such as low perceived usefulness) • contextual barriers (such as lack of time) • patients (such as lack of interest)

(*continued on next page*)

Table 1. (continued)

AUTHOR	COUNTRY	EHEALTH INTERVENTION TYPE	STUDY DESCRIPTION	TYPE OF DISEASE	SETTING	OUTCOME
4. Naszay et all, 2017	Austria	Analyzed eHealth and telemedicine knowledge and awareness and prevalent health app use among Austrian adults	Online survey to collect data, across the country from August to October 2015. -employed the software package sosci survey that offered secure data transmission and access control with personalized links. -a four-phase recruitment strategy, a self-selection snowball recruiting strategy, participants were kindly asked to also forward the invitation e-mail to colleagues or acquaintances in all phase	*no specific disease. General	Austrian internet users' perspectives	**1. Benefit using eHealth** • Health apps have the potential to improve community health and prevent lifestyle diseases cost-effectively and efficiently, and thus build an important pillar of public eHealth. • Regarding aging societies, healthcare providers could take advantage of consumer-oriented health apps by assessing individual needs of specific target groups such as elderly people. **2. Challenges using eHealth** • compared to digital immigrants (35 yo and above), digital natives (35 years old and below) were more likely to use mobile devices and health apps.
5.Athanasopoulou et al., 2017	Finland	Examine computer/internet use for general and health-related purposes, eHealth literacy, and attitudes toward computer/ internet	Data were collected from mental health services of psychiatric clinics in Finland and Greece. 229 patients participated in the questionnaire survey	Schizophrenia spectrum disorders	Outpatient clinics	**1. Challenges using eHealth** • eHealth literacy is either moderate (Finnish group) or low (Greek group)
6. Faccio 2018	Italy	eHealth tools to compensate for family resilience on cancer disease and management	Implementation of eHealth tool to monitor family resilience through questionnaire named fare 120 patients	Cancer	Outpatient settings	**1. Benefit using eHealth** Patients • increase awareness level among patients and family members regarding their resource and importance of supportive family and social network • better adjustment to the disease and reduce probability of mental health problems

						• increase empowerment and support self-management HCWs • information sharing between multidisciplinary team members • monitor the psychosocial dimensions throughout different phases • referral to psychological services is easier and more accessible
7. Huygens 2016	Netherland	eHealth tools for patient's self-management in chronic diseases care	Qualitative study among chronic patients to assess the willingness to use eHealth tools and their expectations and needs related to disease management 30 participants	Cardiovascular & Diabetes	Primary care clinics (outpatient settings)	**1. Benefit using eHealth** Patients • opinions and needs regarding self-management support • patients to receive information on risk and consequences when they are being diagnosed • patient with medical management apps on his mobile phone claimed helpful with medication compliance • Diabetic patients demand a need for an application that automatically sends their blood glucose data to their practice nurse, so he or she could respond to it. • patients believe that by having a mobile apps help in drugs management • most diabetic patients benefited from mobile apps through tracking and sending blood glucose reading to their health nurses to prevent further complaints and manage symptoms at home HCWs • save time since patients can assess the information on the internet. Healthcare professionals can focus on holistic approach rather than health education alone • real time communication with the patients when they experience symptoms based on the readings • continuity of care and monitoring • ehealth as means of cost effective for medical care **2. Challenges using eHealth** Patients • patient feels anxious reading from the internet on the complications of disease • elderly not familiar with the eHealth usage, some mentioned no interest • patients prefer for regular visit to physician

(*continued on next page*)

Table 1. (continued)

AUTHOR	COUNTRY	EHEALTH INTERVENTION TYPE	STUDY DESCRIPTION	TYPE OF DISEASE	SETTING	OUTCOME
8. Peeters et al., 2016	Netherlands	eHealth tools for GPs and health-care users	Online survey 925 participants	General	GP settings	**1. Benefit using eHealth** Patients • Easy looking information such as nutrition and other relevant information • Convenience to contact GP at any time • Privacy HCWs • offers opportunities to client to ask them via internet • Do appointment, reminder of appointment online • Recommendations by GP: able to send reminder through text messages **2. Challenges using eHealth** • Communication with patients through online not explicit enough • Time consuming • No funding • Telephone and face−face more efficient • GPs familiar but reluctant-fear of increasing client, time consuming, not worthy financially
9. Jing Su et al., 2019	China	eHealth tools to evaluate behaviour and clinical outcome	Single blinded RCT 146 participants	CHD patients	Hospital settings	**1. Benefit using eHealth** Patients • Peer support group (motivation) HCWs • enhance communication with peers' groups **2. Challenges using eHealth** Patients • literacy, self-motivation to use the program
10. Miyoshi 2018	Brazil	eHhealth tools use to improve health information system	Cross sectional using hospitals data 27,353 records	Psychiatric patients	Hospital settings	**1. Benefit using eHealth** • Standardization of patient information into one database - easy for monitoring • Helps to improve health information system

HCW: healthcare workers, GP: general practitioner, RCT: randomized clinical trial, CHD: coronary heart disease.

up [14]. First, we identified the patterns of extracted data from the included articles and grouped them before categorizing them into four themes. Then, we re-reviewed each theme's accuracy, usefulness and accurate data representation. The developed themes were then submitted to a group of panel experts well-versed in systematic reviews and public health-related research. The panel expert group subsequently agreed on the themes generated as being appropriate and accurate to the results of the review.

2.4. Quality appraisal

The quality of the 10 studies was ranked using the Mixed Method Appraisal Tool (MMAT) [15], which ensures the quality of the included articles by exploring in detail how the data were extracted for analysis and validation (Table 2). The MMAT is a recently developed tool that has demonstrated an intra-class correlation of 0.8 based on a pilot testing in 2009, and has been proven effective and practical for quality assessment of mixed-method reviews [16]. We performed qualitative analysis and appraisal of the included articles by extracting all relevant information using a predesigned standardised data extraction form [16]. Five study design categories were used for appraising the studies: qualitative, quantitative randomised controlled trial, quantitative non-randomised, quantitative descriptive, and mixed-method study. The MMAT quality scoring scale was scored as yes (20%), unsure (10%) and no (0%) for each criterion. The details of this assessment are reported in Table 2. Overall, the MMAT scores varied from 70% (three criteria met) to 100% (all criteria met). One author crosschecked the assessment results, with disagreement resolved via discussion leading to a consensus.

3. Results

3.1. Benefits of eHealth apps

3.1.1. Patients

In the included articles, patients gained several benefits by using eHealth apps, e.g. saving time and costs [17–19]. As an example, a diabetic patient can send their daily blood glucose reading to health nurses via eHealth apps [17].

eHealth apps also improved communication between patients and health care providers [17]. Clients and health care providers could communicate in real-time online [18]. Besides, patients benefited from eHealth apps in the form of flexibility in contacting their health care providers at any time.

Further, eHealth apps aided continuity of care and the monitoring of psychological status in patients with cancer [20]. Such patients were able to improve their level of awareness and motivation through online support groups [20], and were also able to reduce their anxiety with psychological support from the support group sessions. eHealth apps also improved the awareness and motivations of a patient's family, and allowed patients to recognize signs of adverse effects after receiving treatment. Similar findings among chronic heart disease (CHD) patients showed that eHealth apps increased patient motivation through peer support groups [21]. Another paper showed that eHealth apps aided drug management and compliance among cardiovascular and diabetic patients [18].

Moreover, eHealth apps helped patients to search for information on their disease and other relevant issues such as nutrition and medications [22].

3.2. Health care workers

Aided by eHealth apps, health care workers could focus on a holistic approach rather than health education alone [18]. eHealth also enabled easy referral and information-sharing with other multidisciplinary members regarding patient treatment and planning [20,21]. In addition, eHealth apps saved time in daily operations, enabling health care providers to set appointments with patients online and issue reminders to patients [22]. eHealth also improved and supported health information systems [23], where patient information could be standardized by removing duplicates and including the missing information online.

3.3. Issues or challenges of eHealth apps

3.3.1. Patients

Low socioeconomic status may influence the application of eHealth. In Pakistan, the lack of electricity and poor Internet connectivity are examples of patients' challenges to using eHealth [17]. Lower education status was also a challenge to the application of eHealth [17,21,24]. One study noted privacy issues [22]. Patients also may experience anxiety while using eHealth apps, especially when reading overwhelming information on the complications of their own disease [18]. Age was also one of the challenges patients faced regarding eHealth [19] showed that only younger generations were familiar with eHealth apps.

3.4. Health care workers

Only one paper mentioned the issues and challenges of eHealth apps [22]. Some health care

Table 2. MMAT characteristics of included studies.

Qualitative	MMAT scores	1.1	1.2	1.3	1.4	1.5	Outcome YES/NO
		Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis and interpretation?	
Saleema Gulzar et al., 2013	100%	Yes.	Yes.	Yes	Yes.	Yes.	**Y**
Sanne Lubberding et al., 2014	100%	Yes	Yes	Yes.	Yes.	Yes	**Y**
Huygens et al., 2016	100%	Yes	Yes	Yes	Yes	Yes	**Y**
Quantitative randomized controlled trials	**MMAT scores**	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**Outcome YES/NO**
		Is randomization appropriately performed?	**Are the groups comparable at baseline?**	**Are there complete outcome data?**	**Are outcome assessors blinded to the intervention provided?**	**Did the participants adhere to the assigned intervention?**	
Jing Su et al., 2019	80%	Yes	No. Not complete	Yes	Yes	Yes	**N**
Quantitative Non-Randomized Studies	**MMAT scores**	**3.1**	**3.2**	**3.3**	**3.4**	**3.5**	**Outcome YES/NO**
		Are the participants representative of the target population?	**Are measurements appropriate regarding both the outcome and intervention (or exposure)?**	**Are there complete outcome data?**	**Are the confounders accounted for in the design and analysis?**	**During the study period, is the intervention administered (or exposure occurred) as intended?**	
Miyoshi 2018	70%	Yes	No. Not complete	Yes	Yes	Unsure	**Y**
Quantitative Descriptive	**MMAT scores**	**4.1**	**4.2**	**4.3**	**4.4**	**4.5**	**Outcome YES/NO**
		Is the sampling strategy relevant to address the research question?	**Is the sample representative of the target population?**	**Are the measurements appropriate?**	**Is the risk of nonresponse bias low?**	**Is the statistical analysis appropriate to answer the research question?**	
Naszay et al., 2017	100%	Yes.	Yes.	Yes.	Yes.	Yes.	**Y**
Athanasopoulou et al., 2017	80%	Yes	No. Not complete	Yes	Yes.	Yes	**Y**
Faccio 2018	80%	Yes	No. Not complete	Yes	Yes	Yes	**Y**
Peeters et al., 2016	100%	Yes	Yes	Yes	Yes	Yes	**Y**
Mixed methods	**MMAT scores**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**Outcome YES/NO**
		Is there an adequate rationale for using a mixed methods design to address the research question?	**Are the different components of the study effectively integrated to answer the research question?**	**Are the outputs of the integration of qualitative and quantitative components adequately interpreted?**	**Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?**	**Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?**	
Klocek et al., 2019	70%	Yes	No. Not complete	Yes.	Unsure.	Yes	**Y**

workers found eHealth apps non-beneficial. One example is that communication between health care workers and patients is insufficiently explicit. The other reasons eHealth apps were non-beneficial were that they were time-consuming, health care workers lacked motivation to use them and funding for implementing eHealth technologies was lacking.

4. Discussion

Best practice of patient management is integral within a healthcare system. With advanced technological developments, not only has medical infrastructure become equipped with smart apps, but also conventional forms of consultation can be translated into virtual communication that can take place anywhere. The application of eHealth technologies is often effective for increasing treatment adherence, particularly among patients with chronic diseases [25]. Based on the personalised approach, eHealth utilises Internet network platforms and apps to closely engage with patients [25]. The benefits and issues of eHealth apps can be divided into several themes, discussed in the following sections.

4.1. Accessibility

Previous studies have noted the importance of patient empowerment as one of the dimensions for ratifying the extent of eHealth accessibility [26,27]. Patients can access the Internet through smartphones and tablets, and seek health information materials and services. High-speed Internet connections and wide network reception areas allow patients to readily browse the Internet without restriction. Although the ability to use the system relies largely on varying degrees of digital literacy, the easy navigation interface allows users to become more familiar with it over time [28]. The readability level of information within an interface plays an important role in educating the public on health for all age and educational background categories [29]. For example, glimpsing an interactive graphic display of a disease condition will draw attention and interest, thus arousing further curiosity on the matter. The multimedia-based content is also promising for people with limited health literacy [29]. These convenient tools are easy for patients to use and keep track of their health records. Further, the user-friendly navigation interface of a mobile phone contributes to the acceptance and hence better usage of online health services by patients [30]. In tandem with the recent trend of Internet usage, the preference of the public has likely shifted towards using designated apps rather than browsing through traditional websites [27,28]. This increases the chance of eHealth use related to personalised medical services.

4.2. Adherence

Via personalised patient engagement, adherence to medical treatment and compliance to lifestyle intervention were significantly improved when eHealth was used [27]. Patients feel more at ease with the introduction of a flexible system, and therefore have better understanding and are more compliant with the treatment prescribed. Patients also perceive eHealth services as cost-effective and time-saving [17,19], as the majority encounters difficulty in attending routine clinic check-ups due to job constraints. With the flexibility of online consultation, patients are empowered and hold more responsibility for their health concerns, indirectly improving communication and treatment adherence.

4.3. Health literacy

Currently, online platforms have become the major resources for health information [26]. The high affluent searching trend for self-care and health information-seeking behaviour reflects increased awareness [20] among patients through using eHealth. Patients and their relatives tend to explore information pertaining to their medical condition before consulting health care professionals [31]. Therefore, not only does this improve health understanding, it also heightens awareness and motivation to comply with treatment. By knowing the adverse effects of a disease condition [25], patients can identify such effects early and seek help to prevent further complications.

4.4. Clinical symptoms

Through personalised eHealth apps, patients are more comfortable about expressing symptoms related to emotional and mental wellbeing [29]. When data privacy is secure, patients are more responsive to discussing their symptoms [29,32] without stigma or fear of being judged. Sensitivity regarding certain issues that are difficult to discuss in open conversation can be overcome when using personalised eHealth services. Moreover, an automatic link to an appointed medical doctor when a patient experiences suicidal symptoms, for example, could aid early detection and prompt treatment. Another example is chronic diseases with fluctuating blood parameter levels [18].

4.5. Self-management

In eHealth, patients have the opportunity to self-manage their disease conditions according to convenience. eHealth apps guide patients with clear step-by-step management, for example, to adjust the medical dosage for controlling blood sugar [30]. Patients are familiarised when they self-manage and understand the importance of taking their medicine [25]. When the patient is equipped with sufficient health knowledge, less time is spent in physical consultation with doctors, thus increasing the efficiency of the overall health system at the clinic.

4.6. Health care workers

Flexible-interface multimedia enables health care providers to regularly update the content presentation of eHealth services to ensure constant, regular delivery of health education and promotion activities to large populations [30]. Furthermore, health information can be standardized to reach patients in different age groups through formal channels [27]. Health care workers find eHealth apps easy for referral without the need for hardcopy documentation [20,21]. Integrating services to incorporate multidisciplinary teams in a single eHealth app benefits the health care worker.

The usage of eHealth does not compromise the holistic approach involved in a consultation session with a medical doctor [33]. The ability of eHealth to measure patient wellbeing in various dimensions adds extra value to virtual health care services. Continuity of care is ensured, as eHealth apps are linked to a database and medical doctors can retrieve records online when necessary [27,33]. Therefore, implementing eHealth has the potential to reduce the high volume of patients presenting at health care facilities.

4.7. Limitations

The studies included in this review were conducted in middle−high-income countries with populations with relatively high levels of digital literacy. Therefore, the findings cannot be generalized to low-income countries due to the differing socioeconomic backgrounds. The majority of the studies recruited participants with chronic diseases from at least the outpatient clinic of a primary health care centre or hospital settings, reflecting the patients' high health-seeking behaviour. This factor could contribute to bias in assessing the preference for using eHealth, as existing health awareness strongly influences motivation and enthusiasm for health-related information. Apart from that, the experience of waiting time and having physical consultations with clinicians may also affect the response to shifting to eHealth apps as the communication platform. Overall, the opinions of healthy people on using eHealth for obtaining information on health is understudied in this review. Further, the impacts of the effectiveness of eHealth app services on health outcomes and awareness warrant future research.

5. Conclusion

This systematic review was aimed to provide evidence-based on the impact of eHealth application on health intervention among the provider and consumers. This systematic review might also resolve discrepancies between published studies. The use of eHealth application as an intervention method is becoming an increasingly important aspect in disease prevention, detection and management. eHealth intervention may contribute to more efficient and accessible health care. Important benefits include improved communication between patient and healthcare provider, cost and time saving, and increase awareness and compliance. In contrast, there are barriers to the application of eHealth in health intervention, such as low eHealth literacy, especially from the lower socioeconomic population, and lack of motivation from both parties. Further study on the impact of eHealth application in health intervention is recommended, especially at specific disease implementation, to understand disease plan management better.

Conflict of interest

Authors declare no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

[1] A metadata vocabulary for self-and third-party labeling of health web-sites: health Information Disclosure, Description and Evaluation Language (HIDDEL). In: Eysenbach G, Köhler C, Yihune G, Lampe K, Cross P, Brickley D, editors. Proceedings of the AMIA symposium. American Medical Informatics Association; 2001.
[2] Silber D. The case for eHealth. European Institute of Public Administration Maastricht; 2003.
[3] MAjuMdAr A, Kar SS, GAneSh kuMAr S, Palanivel C, Misra P. mHealth in the prevention and control of non-communicable diseases in India: current possibilities and the way forward. J Clin Diagn Res 2015;9(2):LE06.

[4] Abolade T, Durosinmi A. Telemedicine in Nigeria: a paradigm shift in healthcare delivery. 1935.
[5] Ahern DK, Kreslake JM, Phalen JM. What is eHealth (6): perspectives on the evolution of eHealth research. J Med Internet Res 2006;8(1):e4.
[6] Wantland DJ, Portillo CJ, Holzemer WL, Slaughter R, McGhee EM. The effectiveness of Web-based vs. non-Web-based interventions: a meta-analysis of behavioral change outcomes. J Med Internet Res 2004;6(4):e40.
[7] Jacobs RJ, Lou JQ, Ownby RL, Caballero J. A systematic review of eHealth interventions to improve health literacy. Health Inf J 2016;22(2):81−98.
[8] Hong YA, Cho J. Assessment of eHealth behaviors in national surveys: a systematic review of instruments. J Am Med Inf Assoc 2018;25(12):1675−84.
[9] Hesse BW. Role of the internet in solving the last mile Problem in medicine. J Med Internet Res 2019;21(10):e16385−.
[10] Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 2009;6(7):e1000097.
[11] Lockwood C, Munn Z, Porritt K. Qualitative research synthesis: methodological guidance for systematic reviewers utilizing meta-aggregation. Int J Evid Base Healthc 2015; 13(3):179−87.
[12] Flemming K, Booth A, Garside R, Tunçalp Ö, Noyes J. Qualitative evidence synthesis for complex interventions and guideline development: clarification of the purpose, designs and relevant methods. BMJ global health 2019;4(Suppl 1).
[13] Vaismoradi M, Turunen H, Bondas T. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. Nurs Health Sci 2013;15(3):398−405.
[14] Clarke V, Lane C. Teaching thematic analysis: overcoming challenges and Developing strategies for effective learnina. Clarke & Virginia Braun; 2013.
[15] Hong QN, Pluye P, Fàbregues S, Bartlett G, Boardman F, Cargo M, et al. Mixed methods appraisal tool (MMAT). Registration of copyright; 2018. p. 1148552.
[16] Hong QN, Gonzalez-Reyes A, Pluye P. Improving the usefulness of a tool for appraising the quality of qualitative, quantitative and mixed methods studies, the Mixed Methods Appraisal Tool (MMAT). J Eval Clin Pract 2018;24(3):459−67.
[17] Gulzar S, Khoja S, Sajwani A. Experience of nurses with using eHealth in Gilgit-Baltistan, Pakistan: a qualitative study in primary and secondary healthcare. BMC Nurs 2013;12(1):1−6.
[18] Huygens MW, Vermeulen J, Swinkels IC, Friele RD, Van Schayck OC, De Witte LP. Expectations and needs of patients with a chronic disease toward self-management and eHealth for self-management purposes. BMC Health Serv Res 2016;16(1):232.
[19] Naszay M, Stockinger A, Jungwirth D, Haluza D, Naszay M, Stockinger A, et al. Digital age and the Public eHealth perspective: prevailing health app use among Austrian Internet users Digital age and the Public eHealth perspective. Prevailing health; 2017.
[20] Faccio F, Renzi C, Crico C, Kazantzaki E, Kondylakis H, Koumakis L, et al. Development of an eHealth tool for cancer patients: monitoring psycho-emotional aspects with the Family Resilience (FaRe) Questionnaire, vol. 12. ecancermedicalscience; 2018.
[21] Su JJ, Yu DSF. Effectiveness of eHealth cardiac rehabilitation on health outcomes of coronary heart disease patients: a randomized controlled trial protocol. BMC Cardiovasc Disord 2019;19(1):1−10.
[22] Peeters JM, Krijgsman JW, Brabers AE, De Jong JD, Friele RD. Use and uptake of ehealth in general practice: a cross-sectional survey and focus group study among health care users and general practitioners. JMIR Medical Informatics 2016;4(2):e11.
[23] Miyoshi NSB, De Azevedo-Marques JM, Alves D, De Azevedo-Marques PM. An eHealth platform for the support of a Brazilian regional network of mental health care (eHealth-Interop): development of an interoperability platform for mental care integration. JMIR Mental Health 2018;5(4): e10129.
[24] Athanasopoulou C, Välimäki M, Koutra K, Löttyniemi E, Bertsias A, Basta M, et al. Internet use, eHealth literacy and attitudes toward computer/internet among people with schizophrenia spectrum disorders: a cross-sectional study in two distant European regions. BMC Med Inf Decis Making 2017;17(1):136.
[25] Stevenson J, Campbell Z, Webster A, Chow C, Campbell K, Lee V. eHealth interventions for people with chronic kidney disease (Protocol). 2016.
[26] Risling T, Martinez J, Young J, Thorp-Froslie N. Evaluating patient empowerment in association with eHealth technology: scoping review. J Med Internet Res 2017;19(9):e329.
[27] Schiza EC, Neokleous KC, Petkov N, Schizas CN. A patient centered electronic health: eHealth system development. Technol Health Care 2015;23(4):509−22.
[28] Norman CD, Skinner HA. eHEALS: the eHealth literacy scale. J Med Internet Res 2006;8(4):e27.
[29] Barello S, Triberti S, Graffigna G, Libreri C, Serino S, Hibbard J, et al. eHealth for patient engagement: a systematic review. Front Psychol 2016;6:2013.
[30] Plaete J, De Bourdeaudhuij I, Verloigne M, Crombez G. Acceptability, feasibility and effectiveness of an eHealth behaviour intervention using self-regulation:'MyPlan'. Patient Educ Counsel 2015;98(12):1617−24.
[31] Wang S, Blazer D, Hoenig H. Can eHealth technology enhance the patient-provider relationship in rehabilitation? Arch Phys Med Rehabil 2016;97(9):1403−6.
[32] Privacy aspects of ehealth. In: Slamanig D, Stingl C, editors. 2008 Third international conference on availability, Reliability and Security. IEEE; 2008.
[33] Black AD, Car J, Pagliari C, Anandan C, Cresswell K, Bokun T, et al. The impact of eHealth on the quality and safety of health care: a systematic overview. PLoS Med 2011; 8(1):e1000387.