mHealth and Oral Health Care Among Older People: A Narrative Review

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ABSTRACT

A sustainable strategy is required to help older people maintain their dental health as this population increases and is expected to increase, in addition to the high expense and numerous challenges that prevent them from receiving continuous dental treatment. Through oral health education, mobile health (mHealth) technology may help prevent and manage oral diseases. This study aims to summarise the use of mHealth in oral health care and analyse the facilitators and barriers to adopting mHealth among older people. A systematic review was conducted using the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to search for articles on Web of Science, Scopus, PubMed, Cochrane Library, Google Scholar, SAGE, Wiley online library, and ScienceDirect databases from January 2014 to March 2024. Integrating mobile health (mHealth) into oral health care offers significant potential to enhance care for older people. However, its adoption is hindered by barriers such as technological literacy and accessibility. Overcoming these challenges through user-cantered design and supportive measures is crucial. This review highlights the transformative promise of mHealth for older adults' oral health, calling for continued research and practical efforts to maximize its benefits.

Keywords: mHealth (Mobile health), oral health care, dental care, older people

INTRODUCTION

mHealth can be defined as performing medical healthcare support practice through mobile devices [1]. The World Health Organization's Global Observatory defined mHealth as the practice of healthcare aided by mobile technology, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices, is known as mobile health. These technologies consist of mobile devices like phones, tablets, and smart devices, which play a crucial role in promoting oral health behaviour, oral health management, and oral health knowledge among older individuals [2, 3]. Researchers at the Global System for Mobile Communications Association (GSMA) built a model to predict the growth of mHealth. It is forecasted that Europe and Asia-Pacific will have the largest markets followed by North America. Where the Asian region, China and Japan will account for the market with 37 percent and 21 percent respectively [4]. Latin America and Africa will have the smallest markets. This could be due to various challenges, such as infrastructure, scientific technologies, and resources in implementing mHealth interventions in Africa [5]. Report shows nearly 28% of adults aged 50–80 currently use at least one mobile health app, 16% reported that they used them in the past but not currently, and 56% have never used a health app [6]. mHealth technology can help in improving physical activity levels, normalize BMIs, and alter sedentary and inactive behavior in the aged population. According to WHO, around 10% of the world population (840 million people) is aged 60 years or more, it's predicted that it will increase to 12% (1 billion people) by 2030 [7]. Whereas researchers anticipated that 20 percent (about 88 billion people) will be over 65 years old by 2050 in the United States and 33.3 percent of people will be over 65 years old by 2050 in China [8]. Data from China shows

that 47.27% of families examined in rural and sub-urban have utilized the Internet to get web-based therapy or health-related information. This represents nearly half of the households surveyed. In a comparable pattern, the National Health Interview Survey 2018 found that older individuals are increasingly turning to the internet for health-related information, with 60% of them utilizing it and 38.9% depending on it. World Health Organization (WHO) reported 83% of the countries that were studied have mobile health programs, demonstrating the widespread use of mHealth throughout the world. The results of a statistical study from 2024 states that, with a share of 70 and 66 percent, respectively, India and China are by far the top two countries in terms of health app adoption. Whereas study shows in Canada 62.8%, Korea 64.1% and in US 16% of older adults aged 55 and older had experience using mHealth application regarding oral and other health related issues.

Oral health is a significant part of general health. Poor oral health can influence an individual's appearance, self-esteem, eating, and speaking. The use of mobile phone apps has been growing in the areas of medicine and dentistry simultaneously. However, to date, there is no evidence related to the availability of mobile apps focusing on various branches of dentistry. Studies after 2009 show that 69% of mHealth is used in oral health care. However, according to the literature, the use of mobile apps in oral health is increasing among patients, mainly children and adolescents [9]. Since, acceptance and continued use of mobile health (mHealth) applications are often low among the elderly, significantly plaguing their utility [10]. Despite knowing the potential benefits, the older population's adoption of technology seems to be lower compared to the younger population. This study aims to assess and provide a comprehensive overview of the use of mHealth services in oral health care among older individuals. It also seeks to provide an overview of potential facilitators and barriers to the adoption of mHealth technologies in this specific group of population. The main goal is to specifically highlight the potential of mHealth in enhancing oral health care outcomes in older individuals.

METHODOLOGY

Search Strategy

On 02 April, Online databases, such as PubMed, Cochrane Library, Scopus, Web of Science, and Google Scholar, were searched using the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for data from 2014-2024. The following search strategy were used for each data base; PubMed: ("mHealth" OR "mobile health" OR "telehealth" OR "digital health") AND ("oral health care" OR "dental care") AND ("older people" OR "elderly" OR "seniors" OR "geriatric"), Cochrane Library: (mHealth OR "mobile health" OR telehealth OR "digital health") AND ("oral health care" OR "dental care") AND (older OR elderly OR seniors OR geriatric), Scopus: TITLE-ABS-KEY(("mHealth" OR "mobile health" OR "telehealth" OR "digital health") AND ("oral health care" OR "dental care") AND ("older people" OR "elderly" OR "seniors" OR "geriatric")), Web of Science: TS = (("mHealth" OR "mobile health" OR "telehealth" OR "digital health") AND ("oral health care" OR "dental care") AND ("older people" OR "elderly" OR "seniors" OR "geriatric")), Google Scholar: "mHealth" OR "mobile health" OR "telehealth" OR "digital health" AND "oral health care" OR "dental care" AND "older people" OR "elderly" OR "seniors" OR "geriatric". A total of 1659 records were found on these databases with additional 35 records from other sources.

Studies Selections

Inclusion

1. Studies conducted from 2014 to 2024 will be included in our study.

2. Studies that directly address the integration, use, or exploration of mHealth.

3. Studies that are particularly focusing on individuals with age 55 or more will be included.

4. Provide insights into the facilitators and barriers associated with the use of mHealth for the management of oral health in older adults.

5. Articles published in English language only.

Exclusion

1. Studies that include individuals with ages less than 55.

2. Articles that focus on tele dentistry will be excluded.

3. Articles published before 2014.

Articles Screening

Articles screening using inclusion and exclusion criteria were done in three different phases. To decide whether a publication should be included, the titles and abstracts of every publication found through the search were reviewed in the first phase. Any discrepancies were then rectified. To study the complete texts of pertinent publications from the first phase, it was necessary to get in touch with some writers because the full articles were not easily accessible. In response to the request, a few writers sent their works. The reference lists of the papers chosen in the second phase were examined in the third and final phases. All three screening stages used the same inclusion and exclusion standards.

RESULTS

A total of 1694 articles were screened of which 1659 were identified from five different databases, such as PubMed, Cochrane Library, Scopus, Web of Science, and Google Scholar, and 35 articles were identified from other data sources. 969 articles were identified as duplicates and were excluded from the study. A total of 725 articles were sought for the retrieval which 520 articles were not retrieved. The number of articles that were assessed for eligibility was 205 of which 121 articles were excluded with reason from exclusion criteria, 21 articles were found to be centred on tele-dentistry, 42 articles were found to be focusing on eHealth, 19 articles were not contributing to mHealth in oral health management, 39 articles were excluded for other reasons such as age were not mentioned, the full text of the article was unavailable, and articles that were not in English language (Figure 1).
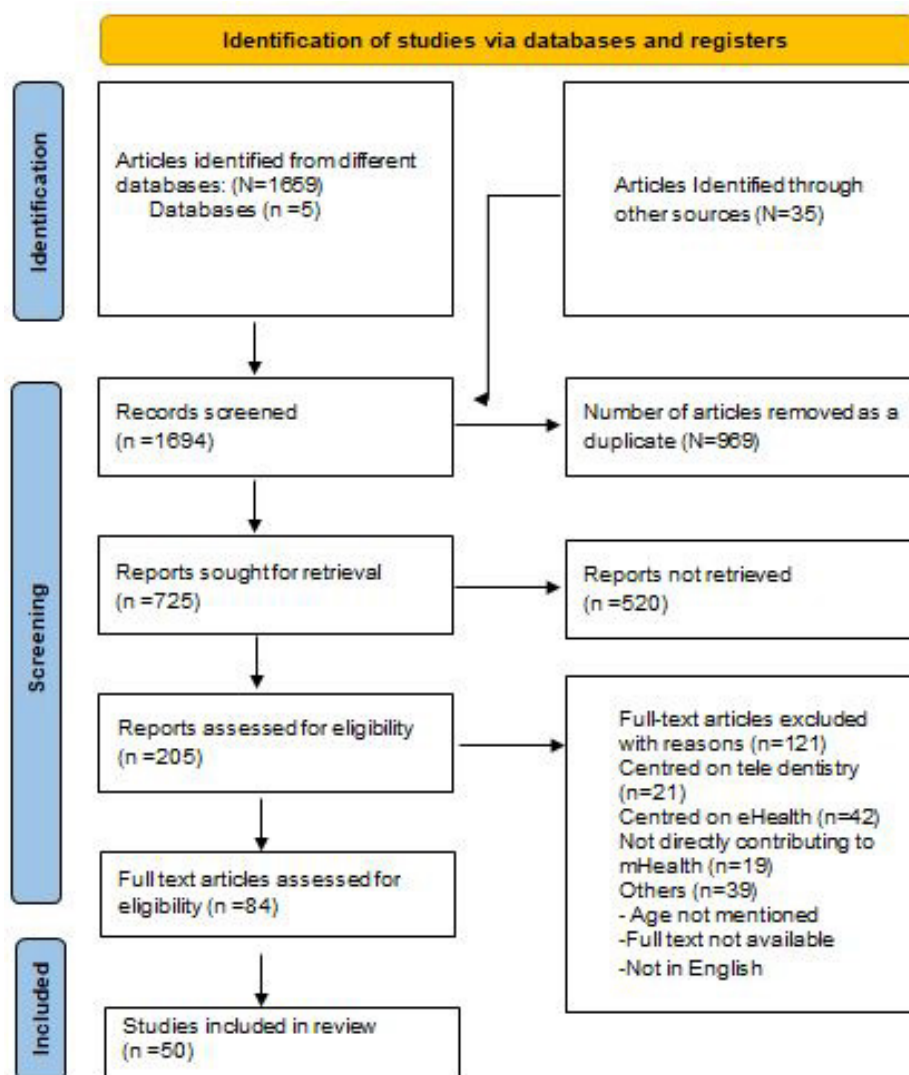

Figure 1: PRISMA flow diagram of study screening and selection.

DISCUSSION

APPLICATIONS OF MHEALTH IN ORAL CARE

The range of mobile health (mHealth) services for managing oral health in older adults reveals a dynamic landscape of functionalities, each enhancing care, promoting health, and contributing to overall well-being. The transformative potential of mHealth in revolutionizing the paradigm of oral healthcare for the elderly can be found through a comprehensive synthesis of pertinent studies [11, 12]. Self-care and monitoring of oral health- The ability of older adults to actively monitor their oral health emerges as a transformative aspect within the realm of mHealth. These mHealth tools manage individuals' oral hygiene routines. These tools participate to enable an interactive process of self-awareness and engagement, encouraging elderly individuals in oral healthcare [13]. Older adults can manage their oral hygiene routines through self-monitoring by using these mHealth tools [14]. These tools enhance their functionality to encompass aspects related to tooth and gum health. As a result, older people have better oral health concerns with newfound clarity, thanks to the visualization of real-time data and insights [15, 16]. Health Awareness and Empowerment Specially Designed Platforms- This mobile health teach elder individuals by disseminating crucial information in ways that appeal to this target audience, ultimately promoting health literacy and reasoned decision-making [17]. Videos, animations, and interactive modules enhance the functionality of these platforms and play a vital role in age-related difficulties such as visual impairments or cognitive challenges [18]. A paradigm shift is enhancing the way older adults' access oral health expertise, driven by the rise of remote consultations and professional guidance within the realm of mobile health. Oral health mobile applications facilitate live communication between older individuals wherever they are located and dental professionals [19]. An emblematic aspect of this innovation is the seamless exchange of visual information between elderly people and medical practitioners. This facilitates practitioners in providing rapid assessments, directions, and recommendations based on the information presented through video data exchange [20]. With the erasing of geographical distance limitations, the convenience of remote consultations ensures that older adults have access to skilled advice and help in this unprecedented age of digital oral health management [21, 22]. Improve Medication Adherence and Routine Care mHealth tools- This provides valuable assistance to seniors managing complex treatment plans that often impact oral health. But they do much more than serve as reminders. These apps are primarily designed to monitor medication administration and provide timely alerts to ensure compliance. By leveraging these applications, older adults can effectively navigate their medication routines with improved ease and accuracy. This capability becomes particularly crucial as they handle multifaceted medication schedules that may involve multiple prescriptions and specific timings. The integration of these apps into their routine empowers older individuals to maintain consistent adherence to their prescribed medications, ultimately contributing to better overall oral health management [23] (Table 1).

BARRIERS TO THE UTILIZATION OF MHEALTH

The importance of oral health as a basic human right is acknowledged; however, over half of the global population lacks access to affordable and adequate oral healthcare [40]. Disparities in oral

Table 1: Showing the use of mHealth in oral health care.

SERIAL NO	TYPE OF APPLICATION	PATIENT SETTING	CLINICAL DOMAIN (SPECIALTY)	FORM OF MHEALTH USED	MODALITIES/ EQUIPMENT
1	Oral Hygiene Reminder [24-27]	Home	Dentistry	Mobile App	Smartphone
2	Gum Health Tracker [28]	Home	Dentistry	Mobile App	Smartphone
3	Dental Appointment Reminder [29,30]	Home	Dentistry	Mobile App	Smartphone
4	Teleconsultation and Telediagnosis for Oral Issues [31- 33]	Home/Healthcare Facility	Dentistry	Mobile App & Video Call App	Smartphone/ Computer
5	Medication Reminder for Oral Health	Home	Dentistry	Mobile App	Smartphone
6	Nutritional Guidance for Oral Health [34,35]	Home	Dentistry	Mobile App	Smartphone
7	Oral Health Education [36-39]	Home/Community Centre	Dentistry	Mobile App	Smartphone/Tablet/ Computer

health access are particularly evident among individuals with low incomes, senior citizens, those with special needs, new immigrants, refugees, Indigenous populations, and residents in rural or remote areas [41, 42]. Challenges arise from a shortage of oral healthcare providers and facilities, geographical obstacles, and the financial burden associated with accessing oral health services, contributing to suboptimal oral health [43, 44]. Additionally, cultural and language barriers, limited education, and a lack of oral health literacy are also linked to poor oral health outcomes [45-47]. Study shows implementation of mobile health in developing countries is challenging. It poses barriers to the widespread adoption and usage of mHealth technology [48].

1. Limited accessibility to technology

One of the biggest obstacles to older people embracing mHealth is the need for more technological access. Despite Malaysia's high smartphone and internet use rates, some older individuals still need access to these tools. About 21.2% of senior citizens in Malaysia need access to cell phones or the Internet.

2. Limited mobile literacy

Lack of mobile literacy prevents elderly people from utilizing mHealth. Mobile literacy is the capacity to use mobile devices and technology to get information and services. The elderly with low mobile literacy may find it difficult to use mHealth technologies, which may deter them from adopting them.

3. Concerns about privacy and security

Privacy and security concerns are hurdles to implementing mHealth among the elderly. Because of worries about the confidentiality and safety of their personal information, elderly people may be unwilling to adopt mHealth technology. Furthermore, some older people may be skeptical about mHealth technology or the healthcare practitioners that utilize it. Security and privacy concerns, especially trust, are key impediments to adopting mHealth among older Malaysians [49].

4. Income

Insufficient income prevents older people from accessing mobile health. On the one hand, mHealth technology may bring on affordable healthcare solutions; on the other hand, the people who cannot afford it may be denied these solutions. It has been reported that elderly ones may also be more reluctant to use different types of mHealth services when the charge is fee-based or when they involve any charges at all. A study found that income was one of the factors causing mHealth to be applied by China's rural doctor's group [50].

5. Limited availability of oral health apps

However, the usability of the mHealth applications for the seniors' oral health is limited and is a barrier to using mHealth among the elderly. Although more mHealth software than fifty billion for general health management is available in Malaysia, no mHealth applications for the oral health of older people have been developed [51].

6. Language and culture barrier

The introduction of mHealth among older people is seriously impeded by linguistic and cultural barriers. Malaysia is the largest, Chinese and Indian people are the second largest, and they all have several different dialects due to it being a multiracial and multilingual country. In general, maintaining high levels of mHealth diffusion among older populations may require involving language barriers and cultural diversity. In a case where elders easily get opposed and are often unaware of their language, using technology developed for Malay may be difficult for them.

Also, older individuals less accepts such technologies due to ingrained cultural values, e.g. conventional medicine they prefer [52].

7. Education

The study stated that the less educated older people were less likely to apply this technology than the most educated persons with a degree [53].

Likewise, the importance of education is responsible for grasping mHealth success among the seniors in the rural area of China.

8. Limited awareness

In many cases, unknown to and for old age person, this technology is used in mHealth systems, which does not allow them to choose the best tools for their health care.

Malaysia's overage citizens are faced with a big challenge in terms of utilizing mHealth as they

have to be referred to for more information. Studies have shown that most elderly Malaysians are not interested in technological mHealth for fear of not knowing the benefits. The study did not uncover, though, that senior people were aware of the various mHealth technologies, and that triggered their inability to choose effectively [54].

9. Limited social support

Social assistance can provide researchers with more effective tools required to overcome language and cultural barriers in mHealth technologies.

It is claimed in a study that the elderly adopting mHealth is a major challenge because of a lack of dealing with the technological infrastructure by them. The research showed that, even when going through the process of getting mHealth devices, isolated older persons and those with little communication with others could use these tools less [55]. Studies also prove that social support would enable older people to mitigate language and culture barriers associated with mHealth technology [56].

FACILITATORS IN THE UTILIZATION OF HEALTH

1. Smartphones and internet connectivity are readily available

Smartphones and a connected Internet of things-based healthcare system are devices that greatly simplify healthcare adoption among seniors. The fact that elderly people can get healthcare services from their own homes is made possible through the availability of cell phones instead of internet connectivity. It has been found according to research that the urban senior population of Taiwan adopting mHealth immensely, is mainly due to access to technology [57]. On the other hand, we can see that Malaysia's smartphone penetration was 81.9% and that internet penetration stood at 87.4% as of the first quarter of the year 2021. What was even more surprising was the finding that 60% of smartphone users in Malaysia are 45 years older or older. As represented by the stated percentages, the majority of senior citizens in Malaysia are known to have mobile devices, together with internet connectivity, making mHealth technology within their reach [58, 59].

2. Support of healthcare providers

The caregivers of seniors can largely help in introducing mHealth services to the aging population. In case their first medical professionals, who are guided by mHealth technology, affirm its use, elderly individuals are more likely to follow suit. It has been proven that healthcare professionals' support is an important factor in fostering the adoption of mHealth among the aging population of Malaysia [60]. Referring to the adoption of mHealth among elderly urban populations, the factors that make a key difference in China is the healthcare providers' endorsement.

3. Friendly User Interface

The first and probably the most important thing is a user-friendly interface that allows older people to use mHealth devices more willingly. Very much the case, most of them do not have a great deal of know much about technology, and a bewildering UI might lead to them abandoning mHealth .A research was done which determined UI as an essential part of getting a senior to adhere to the mHealth program [61].

4. Individualized Care

Personalized care is adapted to older people's idiosyncrasies and inclinations in the sense that health offerings are modified to meet their specific requirements and preferences. mHealth technologies play the role of a doctor at a distance and help in diagnosing, monitoring, and managing health with personalized care. In older individuals, personalization features have played a central role in the promotion of mHealth However, patients with orthodontic fixed appliances can benefit most from smartphone apps designed to improve toothbrushing techniques. Apps and messages related to dental care can be used as clinical instruments to prevent dental disease and improve oral health management, behaviour, and knowledge in senior citizens. Mobile applications with features like progress tracking and reminders to enhance oral hygiene are mostly used [62].

5. Mobile Health Literacy

According to the report by Alam et al, the concept of mHealth education emerges as a leading factor that can be applied to increase the popularity of mHealth among older people [63].

6. Translation of any language

Through the translation solution services elderly persons may find it easier to use the mHealth tools to amend any language difficulties [64]. In a study it shows that language translation is a chief physiological factor that makes the utilization of health apps by the elderly more possible [65].

7. Influence of Phone use on mHealth

The latest Concepts in Mobile Software and healthcare Apps are more practical and efficient approaches to educating older people on how traditional medical services are performed. There are patient-oriented mobile phone apps focusing on oral health promotion, behaviour management, and dental anxiety management. A survey carried out by the PEW Research Center of the US in 2020 realizes that 77% of US citizens own smartphones which are used as the tools that assist with research and maintaining those personal relationships [66]. In case of Malaysia, 61% of the adult population is using smartphones every day. Mobile phone ownership increased significantly in nations with developing and emerging economies in 2015, reaching an international median of forty-three percent of residents (across 40 countries). This technology is a workable structure for directly interacting with consumers' public health interventions. The usefulness of mHealth devices for older people's dental health is the major emphasis of the current investigation (Table 2).

The findings of this study will establish groundwork in dentistry for creating and validating mHealth in oral health care adoption of upcoming oral health research. Various suggestions are proposed to enhance the integration of technology in oral healthcare practices. Educational programs as well as mobile healthcare applications are one of the ways that can serve as a remedy for the mHealth gap for the elderly people. Apps that focus on education relating to oral health should be created for older people, and mobile-based applications that focus on the provision of oral health care as well as digital service management should be introduced. Dental practitioners are being trained that when it comes to advise the older people in the community to take up these technologies will make it possible to assimilate the same. On the other hand, both total policies and regulations should be passed to make certain of the protection of patients, restriction of access as well and management of sharing of mHealth concerning oral care-related data. The findings of the study are dependent on similar settings being applied in their distribution, and additional research must be undertaken to prove if they apply to other populations. Finally, cultural hindrances will involve members who are not English native speakers and may strive to deliver the intended message in the English language. In the end, older people's rudimentary understanding of oral health care literacy grays the effectiveness of mHealth in dental health care, so it is necessary to intensify the process of promoting awareness among people. This study sets the stage for future investigations aiming to understand the viewpoints of diverse stakeholders on mHealth in oral health care in both developed and developing nations.

Table 2: Showing the overview of findings (Barriers & Facilitators).

Factor	Category	Barrier	Facilitator
Privacy & Trust	Extrinsic	Concerns about data privacy and Unauthorized data manipulation [67-70]	Builds trust, and ensures the safety of health information.
Resources	Extrinsic	Insufficient Resources [71-76]	Availability of technology, funding, and human assets
Active Support Network	Extrinsic	Lack of Support	Family, caregivers, peers providing support; social encouragement and healthcare professional endorsement [77,78]
Administrative Processes	Extrinsic	Complicated Administrative processes	Streamlining administration
Technological	Functional	Language and mobile literacy [79-82]	Device
Perspective and Behaviour	Intrinsic	Negative perspectives and behaviour	Understanding and addressing individual perspectives and behaviour
Individual	Intrinsic	Cognitive Overload	Customized User Interface
			Increasing interest and engagement
Relational	Extrinsic	Inadequate motor skills & Mobile self-efficacy	Features include visual accessibility and Personalization [83]
			Utilizing gamification techniques [84]

CONCLUSION

This study concludes that the use of mobile health technologies may be an effective approach to broadening access to healthcare, giving people more control over how they manage their oral health, and possibly reducing the price of dental care. A lack of awareness of the variables driving technology adoption may result in the digital exclusion of older people, particularly in developing countries. However, not many studies are there about older people's adoption of mHealth in dentistry. Sustainable strategies that involve stakeholders, healthcare providers, and researchers are necessary to overcome the obstacles and ensure the long-term effectiveness of mHealth solutions in improving oral health care for underserved populations.

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