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Review

mHealth for Oral Care in Aging: A Narrative Review of Mobile Applications for Older Adults and Caregivers

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Abstract

Population aging is reshaping oral health systems in ways that are difficult to ignore. Such challenges become particularly complex in contexts suffering from strong social inequities, limited access to dental services and/or a growing dependency on informal healthcare. In spite of being largely preventable, oral and dental disease remain highly prevalent among older people. This results particularly worrisome since it is known that oral disease in the elderly has enormous consequences, well beyond the oral cavity and may affect nutrition, frailty and quality of life. It is in this context that mobile health technologies (mHealth) have emerged as potentially valuable tools to support, not only the promotion of oral health, but also its monitoring, education and the training of caregivers. However, it is not yet characterized, to what extent do existing mobile applications properly respond to the specific needs of the older population and their caregivers. This narrative review aims to critically examine the current landscape of mobile health applications designed to improve oral health in older people; with a strong focus on tools oriented to self-care, clinical monitoring, support to caregivers and training of primary attention personnel. We decided to follow the SANRA methodological framework, by summarizing the evidence published in the literature between the years 2000 and 2024 and further analyzing the application's functionalities, their target users, their usability and the strength of the evidence supporting their development and implementation. Our findings reveal a substantial heterogeneity regarding scope, design and validation, as well as a persisting lack of culturally adapted solutions, focus on geriatrics and oriented towards caregivers. In spite of the potential, most applications show a limited clinical validation, a weak integration into health systems and an insufficient consideration of the cognitive, functional and social determinants of aging. Interpreted within global and regional policy frameworks, including the WHO Healthy Aging 2021–30 and the Global strategy and action plan on oral health 2023–30, these results highlight critical gaps and future directions for the development of equitable, evidence-based mHealth interventions in geriatric oral care.

Keywords: oral health; aging population; mobile applications; quality of life; caregivers

1. Introduction

Population aging has become one of the most significant demographic transformations of the 21st century, with profound implications for health systems worldwide [1–3]. By 2050, the global population aged 60 years and older is expected to surpass two billion, with the most rapid growth occurring in low- and middle-income countries. As longevity increases, so does the burden of chronic conditions, including oral diseases such as dental caries, periodontitis, tooth loss, xerostomia, and

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oral mucosal lesions [4–6]. These conditions will affect oral functions such as chewing, swallowing, nutrition, and even, in extreme cases, speech. They also have a negative impact on the quality of life, may lead to increased frailty, and contribute to worsen overall health [7–10]. Even if oral diseases are to a high extent preventable, they remain highly prevalent and frequently untreated in older adults. This is in particular the case of individuals with functional dependence, such as those with cognitive decline, or limited access to dental care [11–15].

As their functional limitations grow with age, a large proportion of older adults need to rely on both formal and informal caregivers to help them with their daily activities, including oral hygiene [16]. Family members, friends, or community members (collectively known as informal caregivers) often provide the higher share of long-term care, however, informal caregivers frequently lack training in both, oral health assessment and hygiene practices [17,18]. On a similar way, trained professionals like formal caregivers and primary healthcare providers often show insufficient knowledge or skills to detect early signs of oral disease or to support consistent oral care [19–23]. These gaps often result in deficient oral hygiene habits, late oral disease detection and worse therapeutic results in older persons [24]. Furthermore, in scenarios with limited education, deficient access to instructional resources and structural barriers partially precluding the availability of dental care, existing inequities in oral health, in particular in resource limited contexts may become dramatically worse. In recent years, tools such as mobile health technologies (`mHealth`) have been developed to contribute to tackle (albeit partially) some of these challenges [25–31].

It is estimated that about 80% of the world's population owns a mobile phone, although rates vary by country and region [32]. Smartphones are becoming pervasive in our societies, digital literacy or a least a widespread use is more common every day, even among older adults and caregivers, unveiling a potential to be used as strategic resources to boost oral healthcare through mobile applications [33–35]. In the context of dentistry, in particular, `mHealth` has been used for various purposes including oral hygiene guidance, caries risk assessment, periodontal monitoring, teledentistry, and strengthening patient engagement [36–40].

In spite this growing interest, mobile applications specifically designed to meet the needs of older adults or their caregivers are still quite uncommon [41] leaving the functional, cognitive, and sensory challenges associated with aging mostly unattended. Furthermore, the quality, usability, cultural relevance, and validation of available apps are extremely heterogeneous, with a few quite advanced options while most of them are extremely limited in their scope and relevance. This variability makes hard for clinicians, caregivers, and policymakers to identify apps that are both reliable and evidence-based [32,42].

Considering these limitations, having a comprehensive and updated narrative synthesis of existing mobile applications for oral care; particularly aimed at older adults and their caregivers is both a pertinent and a desirable goal. The present work has been prepared having broader global agendas in health policy issues, such as the World Health Organization's (WHO) Decade of Healthy Ageing (2021–30) [43–46], the Global strategy and action plan on oral health 2023–30 [47], as well as the mOralHealth programme in collaboration with the International Telecommunication Union (ITU) `Be He@lthy Be Mobile` (BHBM) initiative in mind [32], while also pondering upon local or regional actions such as the ones promoted by the Pan American Health Organization (PAHO) [48,49].

These guidelines and initiatives share the following common goals to improve the oral health outcomes for aging populations:

1. Recognizing the importance of equitable access to care
2. Reach population in remote or low resource settings
3. Providing support to caregivers to develop knowledge and skills
4. Providing motivation and knowledge to empower people to make better choices
5. Building cohesive first level healthcare models
6. Ensuring a person centred approach
7. Implementing a broad use of digital health applications

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Furthermore, we are presenting a critical review of the current mHealth landscape aiming to promote the development of tailored interventions (i.e., ones taking our regional culture and idiosyncrasies into account) for Latin America, since persistent structural barriers to dental services as well as a strong reliance on informal caregiving commonly create complex challenges.

Accordingly, this narrative review seeks to identify, describe, and critically examine mobile applications developed for oral health promotion, education, monitoring, and caregiver training in older adults. The analysis focuses on the range of applications currently available, their intended users and core functionalities, the evidence underpinning their effectiveness, their usability and accessibility for aging populations, and the degree to which they respond to the educational needs of both formal and informal caregivers. This review article also describe current opportunities and limitations, as well as to outline future directions for `mHealth` solutions in geriatric oral care (for a simplified workflow of this work, please refer to Figure 1).

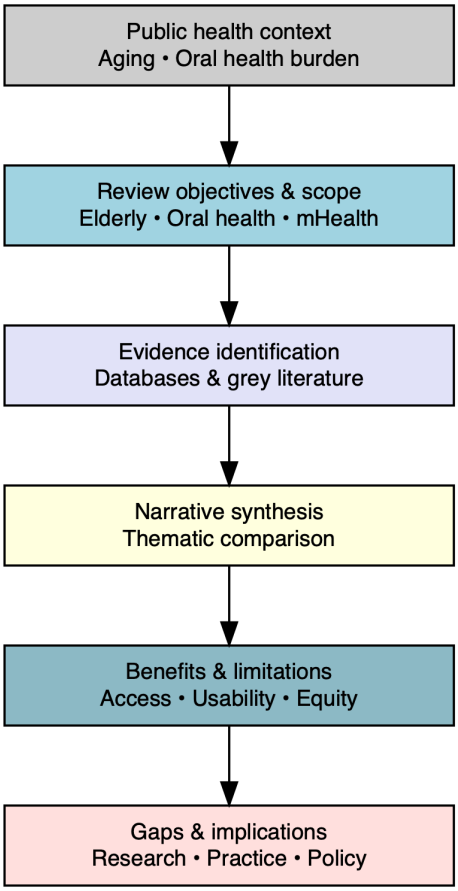

Figure 1. A schematic workflow for this study.

2. Methods

2.1. Type of Review

The present work was developed as a narrative review. We followed the methodological principles for these type of reviews as outlined in the *Scale for the Assessment of Narrative Review Articles* (SANRA) documents [50]. The narrative approach here presented looks for a broader and more flexible engagement with the literature. It is particularly suited to facilitating the integration of diverse (sometimes even disparate) forms of evidence, such as the report of conceptual advances, the introduction of technological developments, and even the emergence of new trends. These features are particularly relevant for complex and dynamic topics like `mHealth` applications for oral care in aging populations (see Figure 2).

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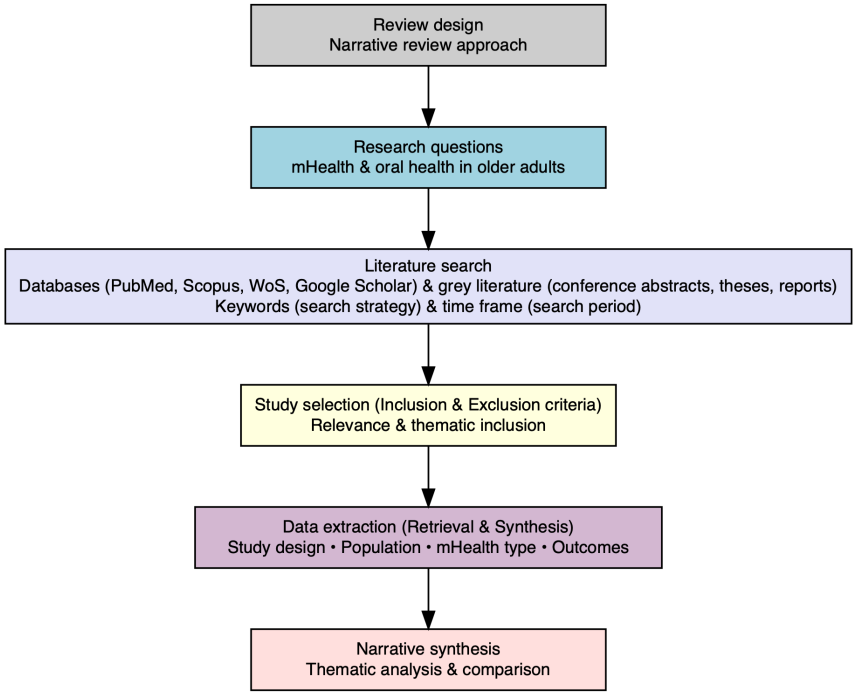

Figure 2. Methodological strategy.

2.2. Search strategy

A systematic and comprehensive literature search was conducted looking to identify published studies on mobile health applications designed for oral health promotion, assessment, self-care, caregiver support, or training of healthcare professionals involved in the care of older adults. The search was carried out by considering four of the largest scientific databases: PubMed, Scopus, Web of Science, and Google Scholar, recognizing their complementary coverage of biomedical, technological, and interdisciplinary research. The search included studies published from January 2000 to December 2024, capturing the evolution of mobile technologies from early handheld devices to modern smartphone-based applications. An additional manual search was performed in January 2025 to ensure inclusion of the most recent publications.

The search strategy combined controlled vocabulary and free-text keywords related to the following:

1. oral health, dentistry, geriatric dentistry
2. mobile applications, smartphone apps, mHealth, digital health
3. caregivers, caregiver training, informal care, long-term care
4. older adults, aging, gerontology

Boolean operators (AND, OR, NOT) were used to refine queries and optimize retrieval of relevant studies.

2.2.1. Search syntax used in each database

- Pubmed
  - (("Mobile Applications"[Mesh] OR mobile app* OR smartphone OR mHealth OR "mobile health")
  - AND ("Oral Health"[Mesh] OR oral health OR dentistry OR dental care)
  - AND ("Aged"[Mesh] OR older adults OR elderly OR aging OR caregiver* OR "long-term care"))
- Scopus

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  - (TITLE-ABS-KEY("mobile application*" OR "smartphone app*" OR mHealth OR "mobile health")
  - AND TITLE-ABS-KEY("oral health" OR dentistry OR "dental care")
  - AND TITLE-ABS-KEY("older adult*" OR elder* OR aging OR caregiver* OR "informal care"))
- Web of Science (Core Collection)
  - TS=("mobile app*" OR "smartphone app*" OR mHealth OR "mobile health")
  - AND TS=("oral health" OR dentistry OR "dental care")
  - AND TS=("older adults" OR elderly OR aging OR caregiver* OR "long-term care")
- Google Scholar
  Given its broad indexing and algorithmic variability, the following condensed terms were used:
  - "mobile app" AND "oral health" AND (older adults OR elderly OR caregiver OR gerodontology)

  The first 100 results were screened following standard recommendations for narrative reviews and Google Scholar indexing practices.

2.2.2. Additional search strategies

To minimize the effects of publication bias and looking to ensure a coverage as comprehensive as possible, we used the following additional strategies:

- reference lists of included articles were screened (“snowballing technique”)
- grey literature (conference abstracts, theses, reports on mHealth development) was not discarded.
- WHO and PAHO digital health documents were consulted whenever needed in order to contextualize public health priorities

2.3. Inclusion and Exclusion Criteria

2.3.1. Inclusion criteria

Inclusion criteria were intentionally broad to capture diverse forms of evidence of `mHealth` applications for oral care in older adults and their caregivers. Eligible articles focused on mobile health applications relevant to oral health, including their development, validation, evaluation, usability testing, feasibility assessment, or implementation. Each study also needed to address an aspect of oral health practice or promotion, such as self-care, clinical evaluation, health education, disease prevention, teleconsultation, or monitoring.

The target populations of interest were older adults aged 60 years or older, caregivers of older adults (whether formal or informal), primary healthcare providers involved in geriatric oral care, and educators or trainees developing competencies related to oral health in older populations. Studies involving any of these groups were considered for inclusion. Eligible study designs encompassed a broad range of peer-reviewed research, including development studies, pilot trials, randomized controlled trials, observational research, qualitative and mixed-methods studies, usability or feasibility assessments, and various evaluation reports. Additionally, only publications dated between January 2000 and December 2024 were considered. Included studies had to be available in full text in either English or Spanish and indexed in at least one of the selected scientific databases.

2.3.2. Exclusion criteria

Studies were excluded if they did not incorporate a `mHealth` component, such as those limited to web-based platforms, desktop software, telemedicine interventions without mobile applications, or general information and communication technology solutions unrelated to mobile apps. Articles were also excluded when they lacked relevance to oral health, including those centered solely on general health, chronic disease management, or aging-related interventions without any oral health component.

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Research involving non-geriatric populations was not considered, including studies on pediatric dental applications or mobile tools designed for adolescents or adults that did not involve caregivers or lacked relevance to aging. Similarly, applications created exclusively for dental students or dentists, without a connection to caregivers, older adults, or community oral health, were excluded. Additional exclusions applied to non–peer-reviewed materials such as conference posters lacking extended abstracts, commercial app descriptions without scientific evaluation, and commentary pieces without empirical data.

Studies were further excluded if they lacked sufficient methodological detail, particularly when descriptions of the mobile application, target users, outcome measures, or evaluation procedures were inadequate, poorly described or absent (For instance, if no objective statistical assessment or randomized trials were performed). Together, these measures aim to secure that only studies directly relevant to the objectives of this review were considered, leaving aside interventions unrelated to the intended focus.

2.4. Data Extraction and Synthesis

As stated, a structured approach to data extraction and narrative synthesis was used to organize and synthesize the somehow disparate body of existing literature on mobile applications for oral health in aging populations [51].

2.4.1. Data Extraction Process

A standardized extraction template [52] was used to systematically compile information from each included study, with two reviewers conducting data extraction independently (MM-G and GG-E) and resolving any discrepancies through consensus. For each article, bibliographic details were recorded. Information about the mobile application itself was also collected, covering the app's name, operating platform such as iOS or Android, stage of development ranging from prototype to commercial release, and the intended user groups, which included older adults, caregivers, primary care providers, and community health workers.

Application features were registered to capture the full range of oral health–related functions offered. These traits included oral hygiene instruction, tools for caries or periodontal risk assessment, monitoring of oral conditions, tele-consultation capabilities and educational modules, as well as reminder systems or behavioral support for dependent older adults or those with cognitive impairment. Details about the study designs and methodologies were also taken into account, in particular, what was the type of study (randomized controlled trial, quasi-experimental, qualitative, usability-focused, etc.), the sample sizes and participant characteristics, and the evaluation instruments employed (for instance, the System Usability Scale, and other technology acceptance measures or clinical indicators).

Relevant outcomes included diverse measures of usability and acceptability, knowledge acquisition, behavior change, caregiver competence, oral health improvements, as well as other indicators of user engagement. The main findings were summarized considering the effectiveness of each application, its barriers and facilitators to use, related cultural or linguistic adaptations, geriatric-specific design considerations, and potential integration of the app into existing healthcare systems.

2.4.2. Data Synthesis

In this work we decided to use a thematic synthesis approach [53]. The entira literaure corpora was categorized into major thematic groups, namely 1) applications designed for older adult education, 2) tools aimed at caregiver training, 3) mobile apps for clinical assessment or monitoring, 4) platforms promoting oral health and behavior change, and 5) apps intended for use by primary healthcare providers. We then carried out a comparative analysis across groups. We look up for differences and similarities in app functionalities, evaluated the methodological rigor of each study, as well as the extent to which gerontological adaptations were incorporated [54].

These analyses were subsequently interpreted in the context of broad international policy and public health frameworks, such as the WHO Global Strategy on Oral Health, the PAHO digital health

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priorities, the WHO Decade of Healthy Ageing, and the health-related issues from the Sustainable Development Goals and the ASSA2030 agenda. We also identified key gaps and future directions of research and development. Putting an emphasis on the subsisting absence of culturally tailored applications for Latin American populations, the scarcity of validated mobile tools designed with dependent older adults in mind, and the limited number of interventions specifically supporting caregivers.

3. Findings

The search strategy identified a heterogeneous body of studies addressing the development, usability, evaluation, or implementation of `mHealth` applications for oral health promotion, monitoring, caregiver training, and geriatric care. A total of 1,163 records were initially identified across the selected databases. After removing 121 duplicate records, 1,042 studies remained for screening. Based on title and abstract review, 40 articles were selected for full-text assessment. Following the application of the predefined inclusion and exclusion criteria, 26 studies were ultimately included in the final synthesis. The selected studies (including both application development and/or research evaluation of the app and published in scholarly journals) demonstrated substantial variation in methodologies, target populations, and technological functionalities. Nevertheless, the findings could be organized into six major thematic categories that reflect the main directions of current research and development in mobile applications for oral care in older adults and caregivers.

3.1. Mobile Applications for Oral Health Education and literacy in Older Adults

Many applications identified in the review were specifically designed to give oral health education and literacy to older adults, with a marked emphasis on hygiene practices, disease prevention, and self-care strategies at home [55–57]. These tools often offer detailed instructions for brushing and interdental cleaning illustrated by animated demonstrations or short instructional videos [58,59]. A broad number also included personalized reminders to encourage daily hygiene habits and incorporated features for progress-tracking intended to support sustained engagement [60,61]. Most applications have simplified interfaces with large icons, minimal text, and are easy to navigate [39]. For instance, Ming Ng and coworkers [58] developed a progressive web application used to provide either verbal instructions or illustrative demonstrations for a number of hygienic procedures to elderly subjects. Afterwards the authors applied a randomized trial to assess the effectivity of the web application by evaluating changes in a given knowledge score, as well as plaque index, gingival index and denture plaque during a follow-up period of 3 months. Both cases shown statistically significant improvement yet the one using the web app further lowered the gingival index score.

A similar effort was carried out by Ki and collaborators who developed a mobile application OHEMA. The autors also performed a randomized clinical trial to evaluate the app's performance assessing unstimulated salivary flow rate, subjective oral dryness, tongue pressure, and swallowing-related quality of life via standardized and validated pre- and post-intervention surveys [57]. Statistical significant improvement was found for tongue pressure, unstimulated salivary flow and in some groups for oral dryness and swallowing-related quality of life.

Aside from hygiene instruction, a number of these apps include educational contents centered around caries, periodontitis, swallowing-related quality of life and xerostomia prevention in the aged population [57,62]. These sources offered information about risk factors for dental caries and periodontitis, as well as management strategies for masticatory efficiency and oral biomechanical functions [63]. Also included were dietary recommendations regarding cariogenic food exposure and advisory information on early signs of periodontal disease. However, only a few applications offered personalized recommendations or data-driven advice tailored to the individual clinical state of the users and they were often available only in quite specific languages, most of them only in English [64].

Some of these instruments are designed to improve oral health literacy by defining key concepts with common language, providing guidelines to recognize and explaining common symptoms [37]. However, many of these tools lacked on linguistic diversity and cultural adaptation (most of these applications were available in only one language, in most cases English). This directly impacts on

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their pertinence and accessibility for non-english speaking people and highlights the need to develop culturally aware and adaptable oral health education technologies [34].

3.2. Mobile Applications for Surveillance, Assessment and Early Detection of Oral Health

Another important group of apps is centered on remote surveillance, self assessment, early detection and digital support to evaluate oral health [39,65]. Several studies described tools that allow its users to take intra-oral pictures using a smartphone camera [66–68]. These images may be evaluated by dentists for remote consultation [69,70]. These images can also be used to surveillance and monitor changes over time, or processed with basic image recognition algorithms to provide preliminary evaluations [36]. However, the accuracy and usefulness of these features were often constrained by the quality of the photographs taken by older adults, as well as by inconsistencies in lighting, angle, and positioning during image capture.

Several of these apps offer guidance for selecting appropriate oral care products; others also provide a structured guide for performing oral self-examination [60]. These tools instruct users on how to identify persistent ulcers, erythematous or leukoplakic lesions, as well as signs of gingival bleeding and chewing discomfort [71]. However, even if this so-called *self examination modules* were, in general, well received and accepted by the users, they lacked of a rigorous validation by clinical practice standards. This, of course, makes them unreliable for clinical decision making or early disease detection [72].

A few of these apps are aimed at evaluating oral hygiene, early detection and functional aspects of oral health, including perceived salivary flow, loss of chewing ability or chewing discomfort, swallowing difficulty, and dryness of the oral mucosa [73,74]. These features may be fit to be used within community-based screening campaigns or as auxiliary tools for home-based surveillance among frail or dependent older adults [75]. These mobile health tools could potentially become a complement to traditional clinical evaluations with accessible, user-friendly functional evaluations [76,77].

The group of Park in Korea developed a mobile application (HAHA2022) used as a *digital health coach* to accompany elderly adults with chronic diseases in their oral health day to day management [78]. Usability was measured using the Korean version of the Mobile Application Rating Scale and was determined to be highly acceptable and feasible for use by this population in a mixed evaluation strategy involving both general population adult subjects and expert panel members. It is argued by the authors that the age-friendly features and digital health coaching capabilities will improve its adoption and ongoing use and in this way becoming an aid to prevent digital disparities and oral health inequities.

3.3. Mobile Applications for Training Formal and Informal Caregivers

An additional group of apps was designed with caregivers in mind as they play a central role in supporting the oral hygiene or emergency management and traumatic dental injury of dependent older adults [79–81]. Some of these tools were particularly focused on dementia care and offer simplified routines adapted to cognitive impairment. They also incorporated behavioral strategies to manage resistance during oral hygiene activities. Some others include short instructional videos and literacy modules to explain, for instance, oral health complications commonly associated with dementia [82].

Even if several studies reported consistently high satisfaction levels among the caregivers using this kind of apps, the same studies pointed out that these materials are limited in terms of cultural adaptation potential, hence diminishing their impact on diverse populations [83]. Some applications allow caregivers to record and keep track of the daily oral hygiene routines of their patients. These often include features to keep track of the state and maintenance of dental prostheses, warn about simple symptoms and changes in the oral cavity and monitor adherence to treatment. These functionalities help to improve the communication between care givers and health professionals by providing them with structured documentation of and follow-up information that may be shared between them [84].

Other applications further incorporated reminder systems for hygiene routine and dental appointments, alerts for symptom monitoring. Some of them have integrated options for synchronous

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or asynchronous teleconsultation. Although these addtional features expand the potential of mobile health tools to support continuous and coordinated care, integration with formal healthcare systems remains uneven [35].

3.4. Mobile Applications for Training Primary Healthcare Personnel and Dental Providers

A fourth category consists of applications designed to train healthcare providers, in particular, those working with older adults, either in community or institutional environments [85]. These training tools typically offer content related to geriatric oral health, as well as instruction on clinical evaluation practices, and make use of interactive learning aids in the form of quizzes, thematic lessons, and case-based scenarios [84,86].

A few applications integrate clinical decision-support features to assist providers in identifying oral health risks, determining when referrals are needed, providing clues for preventive interventions in older adults [87]. These decision-support tools may result specially useful in regions where access to specialized dental services is limited, as they offer a guide to frontline providers in managing oral health needs within their scope of practice.

Some tools support community-level assessment by allowing digital data collection on oral health indicators. Community supports enables screening activities at the primary care level to provide data for large-scale oral health surveys [40]. Due to these possibilities these may become valuable assets for public health programs. The data can be integrated into surveillance systems and used to monitor oral health trends, to ultimately guide population-level interventions.

3.5. Evaluation of Effectiveness, Acceptability, and Usability

Evaluation of mobile applications has shown a broad variability in scope and methodological rigor. Particularly useful were those evaluations including user and caregiver survey test. Although these tests contributed to better applications, only a small number of studies employed formal co-design methodologies, and very few included participants from diverse cultural or socioeconomic backgrounds [33,86,88].

Adult users are commonly challenged when facing new technologies and this is yet another challenge for `mHealth` adoption. A number of reasons may be behind this; we can mention limited digital literacy, visual or motor impairments, difficulties in capturing clear intraoral images, and overly complex or non-intuitive interfaces were the most common [80,89].

Most tools are available only in English, very few of them provide culturally adapted content. This represents a significant obstacle for global implementation in regions such as Latin America, Asia, and Africa. The absence of multilingual options and examples adapted to the different cultures limits the usability and relevance of these tools [90].

3.6. Gaps Identified in the Literature

Several critical gaps were identified in the current state of app research and development. One important limitation is that few applications were specifically designed for informal caregivers. Certain tools will indeed offer indirect support for caregiving tasks, almost none is intentionally developed to address the daily challenges faced by them [83].

There is a very limited number of clinically validated interventions. While most of these apps claim to have broad usability and some of them have become somewhat popular, no measurable clinical benefits or long-term improvements in oral health have been reported. The evidence about their effectiveness remain thus weak. This fact makes difficult to justify their integration into formal care guidelines or public health programs [33,91].

Accessibility for older adults with cognitive impairment also remains low. Only a small number of applications incorporate features tailored to individuals with dementia, mild cognitive impairment, or frailty, despite the high prevalence of these conditions in aging populations. This omission restricts the usefulness of many `mHealth` tools for those who may need them most [84,86].

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A further limitation is the absence of long-term evaluation. Few studies include extended follow-up periods, assessments of sustained adherence, cost-effectiveness analyses, or evaluations of how these tools integrate into primary care, dental services, or community-based programs. The lack of long-term and system-level evidence inhibits the ability to scale interventions or determine their real-world impact on oral health outcomes in older adults [84,86].

3.7. Available products

Regarding currently available (either commercial or institutionally-backed) `mHealth` applications, some of the more widely used/adopted are the following:

1. `Dental.Aging.Tips` App is a Progressive Web App, i.e. a regular website, that also can function as an installed app on mobile devices developed to help healthcare providers, family caregivers and users in nursing homes and care centers, including home https://dental.aging.tips/, reviewed in https://www.deltadentalinstitute.com/news/press-releases/research-finds-new-app-supports-improved-care-for-persons-living-with-dementia/, https://dimensionsofdentalhygiene.com/new-mobile-app-helps-improve-oral-care-for-patients-with-dementia/, https://www.drbicuspid.com/dental-hygiene/article/15663852/iowa-dental-school-tests-oral-health-app-for-dementia-caregivers and https://adanews.ada.org/huddles/dental-school-uses-app-to-support-caregivers-of-patients-with-dementia/. See also a commentaries by Veseli et al [92] and by Ashida et al [79].
2. `GeriaDental` App is focused on the oral health of older adults, highlighting a mobile application that provides expert advice for caregivers, as well as a line of assistive products (such as denture lifters) designed for older individuals with specific needs, helping to overcome barriers and improve oral hygiene in this population https://apkpure.com/geriadental/io.appery.project409228, reviewed in https://www.oralhealthgroup.com/news/geriadental-app-helps-improve-oral-health-for-older-adults-1003949028/, https://www.deltadentalinstitute.com/news/press-releases/delta-dental-institute-funds-new-oral-health-research/.
3. `ToothPortal` App https://news.ubc.ca/2025/08/toothportal/. The ToothPortal application is a teledentistry tool developed by the University of British Columbia (UBC) that allows caregivers, nurses, physicians, and patients to upload information, photographs, and oral health–related medical details directly to a dental team for evaluation and triage. It facilitates access to dental care for older adults living in residential facilities and enhances undergraduate training in geriatric dentistry. It is not a general public app, but rather a specialized platform. It has been reviewed in https://www.karmactive.com/ubc-toothportal-app-transforms-senior-dental-care/, https://www.oralhealthgroup.com/dental-students/ubc-teledentistry-app-connects-seniors-in-long-term-care-with-student-dentists-1003988924/.
4. `TEGO` App (in Spanish) [93]. The TEGO Dental mobile application is a Chilean educational platform specifically designed to promote oral health and self-care among adults aged 60 years and older. It is aimed at older adults, with the goal of providing education and literacy to support oral self-care. The app offers content and interactive games, using audiovisual strategies to communicate various aspects of oral health. It is also part of a broader geriatric teledentistry initiative. The project is a collaborative effort led by the University of La Frontera (UFRO) and carried out in partnership with researchers from the Universities of Valparaíso and Talca, within the framework of the Consortium of State Universities of Chile (CUECH). It has been reviewed in https://revistaschilenas.uchile.cl/handle/2250/182165, https://odontologia.ufro.cl/cidic-ufro-presenta-aplicacion-movil-de-salud-oral-para-personas-mayores/, https://www.iie.cl/tego-ufro-presenta-app-para-salud-oral-de-adultos-mayores/, https://revistas.udec.cl/index.php/journal_of_oral_research/article/view/7521 and https://repositorio.uchile.cl/handle/2250/203583.
5. `Brush DJ` App, https://www.brushdj.com developed to use the potential of mobile applications to promote evidence-based oral hygiene practices, the app is designed to encourage users to

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brush their teeth for the recommended two minutes by playing music during the routine. The app enables users to schedule reminders to brush twice daily, use mouthwash at a time separate from toothbrushing, keep track of upcoming dentist, hygienist, or therapist appointments, and replace their toothbrush every three months [89], reviewed in https://brush-dj.en.aptoide.com/app, https://www.harmonydentalbeaverton.com/blog/brush-dj-app-motivates-kids, and https://bridgingapps.org/bridgingapps-reviewed-app-brush-dj/.

6. `iGAM` App https://aan271.wixsite.com/igam [62]. The iGAM dental app is an mHealth application designed to monitor gingivitis using self-taken dental photographs (dental selfies). It facilitates communication between patients and dentists for remote monitoring of gingival health and supports improvements in oral hygiene through questionnaires and educational articles. The app allows users to take photos of their gums, assess gingival health, receive personalized treatment plans, and obtain recommendations to visit a dentist when necessary. Aside from the patients themselves it can also be used by their caregivers.
7. `Tooth Memo` (formerly Oral Health Survey Mobile Application, OHSMA) https://play.google.com/store/apps/details?id=codeinfinite.toothmemo, https://apps.apple.com/th/app/tooth-memo/id1596430624 is an app developed by researchers at Chulalongkorn University in Thailand to modernize epidemiological data collection in dentistry [86]. It was designed to record individual dental treatment histories and oral health status. Individuals and caregivers can use it to document their personal dental treatment history, while dental health professionals can use it to record data from oral health surveys conducted among patients.
8. `OSCA` [94]. The Oral Self-Care App (OSCA) is a personalized, evidence-based mobile health tool specifically designed to improve oral hygiene for patients with periodontal disease.

Table 1. Currently available mHealth applications for oral health in older adults and caregivers (Summarized view)

Product name	Target users	Main purpose	Key functionalities	Special features / limitations
Dental.Aging.TipsApp	Healthcare providers, caregivers, institutionalized older adults	Support oral care in aging and dementia	Evidence-based guidance, step-by-step oral care instructions, dementia-focused content	Progressive Web App; strong caregiver focus; limited long-term clinical validation
GeriaDental App	Older adults and caregivers	Improve oral hygiene in older adults	Educational advice, caregiver guidance, integration with assistive products	Includes physical assistive tools; limited published effectiveness data
ToothPortal	Caregivers, nurses, physicians, dental teams	Teledentistry and remote consultation	Upload intraoral images, clinical data sharing, professional review	Institutional platform; not a general public app
TEGO App	Older adults (Spanish-speaking)	Oral health literacy and self-care	Educational modules, audiovisual content, interactive games	Culturally adapted; limited geographic availability
Brush DJ	General users including older adults	Promote evidence-based oral hygiene habits	Timed brushing with music, reminders, appointment tracking	Not specifically designed for older adults; widely adopted
iGAM App	Patients and caregivers	Remote monitoring of gingival health	Dental selfies, questionnaires, dentist feedback, educational content	Requires adequate photo capture skills
Tooth Memo (OHSMA)	Individuals, caregivers, dental professionals	Oral health data recording and surveillance	Dental history documentation, epidemiological data collection	Primarily research- and surveillance-oriented
OSCA (Oral Self-Care App)	Patients with periodontal disease	Personalized oral self-care support	Evidence-based recommendations, personalized feedback	Focused on periodontal care; limited caregiver-specific features

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4. Discussion

This narrative review synthesized current evidence on mHealth applications developed for oral health promotion, monitoring, caregiver support, and professional training in the context of aging populations.

Our findings reveal that digital innovation in oral health is advancing with a fasta pace. However some specific needs of older adults and their caregivers, both formal and informal have not being considered yet. Having so many different applications talks about the potential of mHealth to address relevant issues in geriatric oral healthcare. Yet, our study still found important limitations in their accessibility, validation, and clinical integration.

We could see a growing use of mobile applications for oral health education and literacy. Relevant areas include hygiene instruction [34,89,95,96], disease prevention [40,88,97], and oral health literacy [37,98]. Developers expect that adoption by older adults will fowllow just by providing simple navigation tasks and multimodal (text, video, interactive communication, etc.) educational formats [80,99,100]. Most of the existing apps are, however, rather generic, instead of being tailored to the clinical realities of aging in individuals. Aged persons present diverse symptoms and issues: xerostomia, multi-morbidity, prosthetic rehabilitation, or reduced functional abilities, among many others. Furthermore, just a handful of apps are able to cope with cultural heterogeneity or language diversity. This limits their use for non-English-speaking populations, reinforcing inequities in access to digital oral health resources [90].

Specific applications for the monitoring and evaluation of oral health are a promissory avenue for development. In particular those including intraoral photography, self-examination instructions, and functional evaluation tools [62,101,102]. Such tools may positively impact early detection of oral diseases in older adults, specially those with restricted mobility or restricted access to dental services. Their real-world applicability is however, still constrained by technological barriers, including the difficulty older adults face to capture good intraoral images and the lack of clinically validated automated recognition systems. Perhaps more relevant, very few of these tools have been tested as part of integrated care pathways or connected to teleodontology systems capable of providing actionable professional guidance [93,103,104].

One of the greatest gaps is the limited availability of applications designed with caregivers in mind. This is so, in spite of the clear recognition of the central role that caregivers play in maintaining oral hygiene in dependent aged adults. Even when some applications offer basic modules oriented to caregivers or follow-up tools, quite few really dig into the complex challenges involved in adult people care. These include how to manage resistance to oral hygiene, adapt to the routines of care due to cognitive impairment, or keep close communication with health professionals. These results particularly problematic given the global rise of informal care and the high prevalence of oral disease among dependent aged adults. Developing evidence-based mobile tools to help with the training of caregivers, support decision making and provide real time orientation should be a priority for future innovation [105,106].

The review also unveiled the scarcity of applications developed for the training of primary care professionals and dentists [84,86,87]. Such apps have the potential to improve the capabilities in geriatric oral health, in particular in limited resource scenarios or those where spacialized geriatric dentistry is scarce. Integrating oral health modules in existing digital training platforms may be an alternative to strengthen primary care [47].

As previosuly mentioned, a cross-cutting limitation in the literature is the lack of rigorous evaluation of mHealth applications. Most studies focus on usability, user satisfaction, or conceptual app descriptions, with very few assessing clinical outcomes, behavioral change, or long-term effectiveness [107,108]. Randomized controlled trials, longitudinal studies, and real-world implementation research are almost entirely absent [109–111]. Without robust evidence, it remains challenging for clinicians, policymakers, and public health institutions—including the WHO and PAHO—to recommend or integrate specific applications into geriatric oral health programs.

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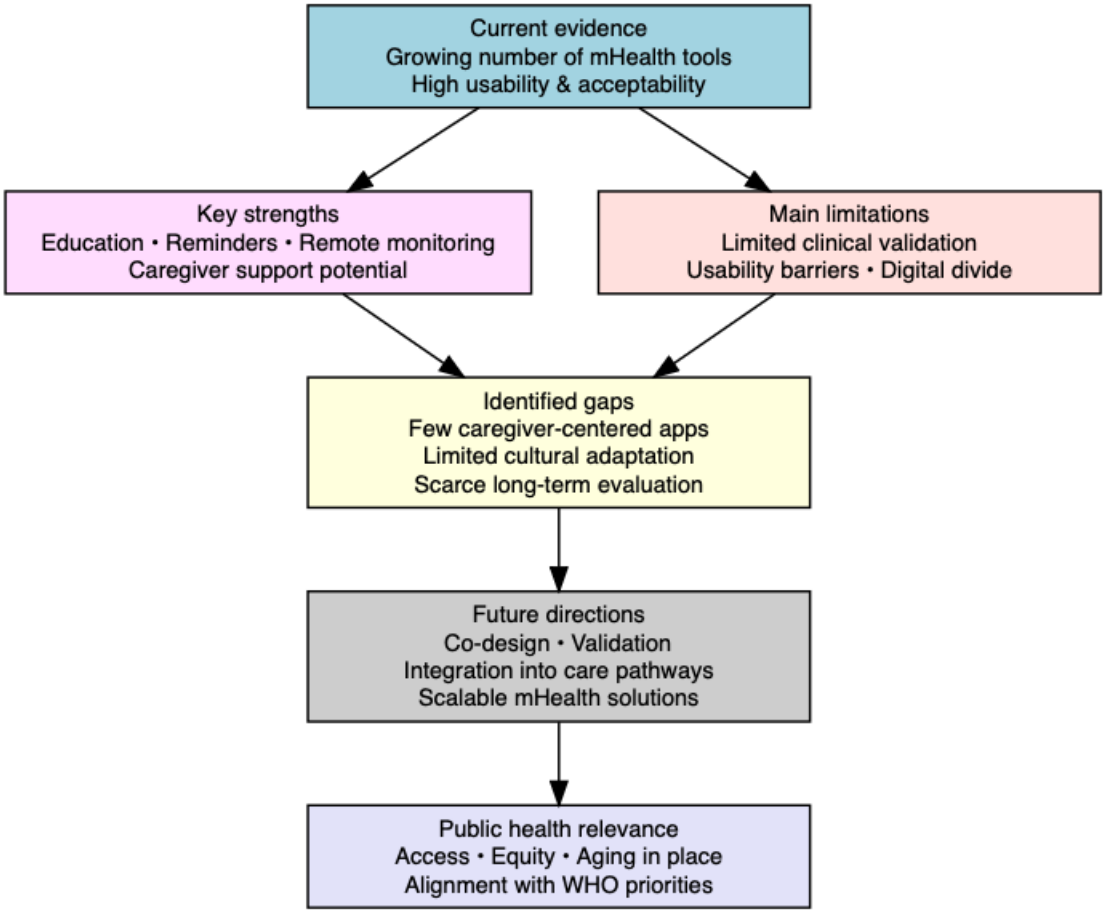

Figure 3. Simple summarizing the main points discussed in this work.

Beyond clinical effectiveness and usability, and in light of the limited empirical validation identified in this review, the findings also raise important ethical considerations related to ensure confidentiality, data use and storage, interoperability or integration with other digital health information, algorithmic decision support, and trust in `mHealth` interventions for geriatric oral care [32,112]. As mobile applications increasingly collect longitudinal information from older adults, caregivers, and primary healthcare providers, questions surrounding data privacy, informed consent, and responsible data use become particularly salient in vulnerable populations [113]. Emerging applications of artificial intelligence and machine learning in digital health have shown potential to support risk stratification, personalized guidance, and decision support; however, their use also introduces concerns regarding transparency, bias, and interpretability [114]. In the context of geriatric oral health, where data are often incomplete, caregiver-mediated, or context-dependent, careful ethical oversight and human-centered design are essential to ensure that data-driven tools augment—rather than replace—clinical judgment and do not exacerbate existing health inequities.

We should also mention the existence of persistent barriers to usability and accessibility for older adults, including the visual impaired, and those with reduced dexterity, low digital literacy, and cognitive decline [115,116]. These factors must be taken into account in app design, yet few studies incorporate formal co-design methodologies or user-centered design processes involving older adults or caregivers. Accessibility functions such as voice-assisted navigation, high-contrast interfaces, adaptive text sizes, and simplified workflows remain inconsistently implemented, if at all. Addressing these design gaps is essential to ensure that `mHealth` tools do not reinforce existing inequities.

From a public health perspective, the findings align with broader global priorities. Indeed, the WHO's Global Strategy on Oral Health [47], the PAHO Regional Digital Health Strategy [2], the mOralHealth programme [32], and the WHO Decade of Healthy Ageing 2021–30 [46], all emphasize

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the need for digital innovations that promote equitable access, integrate oral health into primary care, and support caregivers. However, despite alignment occurs in principle, few applications identified in this review operationalize these frameworks in practice. There is thus a clear opportunity for interdisciplinary and intersectoral collaboration (including actors such as academic institutions, health ministries, community organizations, and technology developers) to create scalable, culturally relevant tools that address the unmet oral health needs of older adults.

`mHealth` technologies hold considerable promise for improving oral health outcomes in aging populations by enhancing education, literacy, facilitating monitoring, empowering caregivers, and strengthening primary care [36,39,117]. Yet, current applications are fragmented, inconsistently validated, and insufficiently tailored to the realities of older adults and those who care for them. A coordinated research agenda is needed to support the design, evaluation, and implementation of evidence-based applications that can be integrated into comprehensive geriatric oral healthcare models [39,118–120].

5. Conclusions

This narrative review demonstrates that `mHealth` applications hold substantial potential to improve oral health outcomes among older adults by enhancing education, literacy, supporting self-care, enabling remote monitoring, and strengthening the role of caregivers and primary healthcare providers. Across diverse studies, `mHealth` emerges as a promising tool for addressing long-standing barriers in geriatric oral health, including limited access to dental services, low oral health literacy, and the growing dependence on formal and informal caregivers for daily hygiene practices. However, despite technological advances, the current landscape of apps remains fragmented, uneven in quality, and insufficiently tailored to the unique clinical, cognitive, and functional needs of aging populations. A main goal was to highlight several critical gaps: the scarcity of applications specifically designed for informal caregivers, limited clinical validation of existing tools, low accessibility for users with cognitive impairment, and the absence of long-term evaluations of effectiveness and real-world implementation. Furthermore, cultural and linguistic limitations significantly restrict global applicability, particularly in low- and middle-income regions where digital health innovations could have the greatest impact. Without robust, user-centered design and evidence-based evaluation, many `mHealth` solutions risk falling short of their intended goals.

Future initiatives should prioritize interdisciplinary research, equity-driven design, and integration with community and primary care systems. Such efforts have the potential to bridge existing gaps, empower caregivers, and support healthier, more dignified aging for populations around the world.

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