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Review Article

Dentistry Section

Chances and Challenges of Mobile Health in Public Health Dentistry

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ABSTRACT

The future of healthcare delivery keeps evolving and mobile phone technology may have a huge role to play. Mobile Health (mHealth) is a facet of Electronic Health (eHealth) that involves the use of mobile phones and other wireless devices in medical practice. The effectiveness of mHealth has been proven in different studies, as well as, in different aspects of medicine and dentistry. Text messaging has made significant progress in delivering health education for maintaining oral hygiene, especially for orthodontic patients as well as tobacco cessation counseling. Mobile phone applications incorporate various features like gaming, audio, and video messages to engage smokers in several behavioural change strategies. mHealth technology has made an immense contribution to contact tracing, screening, and teleconsultation during the Novel Coronavirus Disease-2019 (COVID-19) pandemic. Given that mHealth is a low cost, easily accessible, and widely available means of communication, it has the potential to play a significant role in public health dentistry.

Keywords: Dental public health, Electronic health, Health education, Telemedicine

INTRODUCTION

The usage of mobile or any wireless technologies has the potential to evolve the delivery of healthcare services all across the world. Over three billion individuals use mobile phones and other devices with wireless technologies around the world. Mobile devices, with their large user base, can be an effective mode of communication for healthcare services [1]. The Global Observatory for eHealth defined mHealth as medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices. It refers to the use of the mobile phone's core utility of voice and short messaging service, as well as, more complex functionalities and applications such as general packet radio service, third and fourth generation mobile telecommunications, global positioning system, and Bluetooth technology [2]. Teledentistry is a broad term that encompasses a broad range of techniques as well as virtual technology the most common of which are computers and mobile devices [3]. In this generation, this prevailing technology is increasingly being utilised in dentistry to spread dental health education through a smartphone [4]. The patient for a public health dentist is the general population or the entire community. The resources are scarce, and the impact is massive because nearly everyone has the disease. Dental public health, without a question, is the most challenging specialisation in dentistry [5]. mHealth has the potential to serve in numerous fields of healthcare such as information, health promotion, screening, helplines, etc. Mobile technology can close the voids in the healthcare system by expanding access at a lesser price as well as, reaching remote areas where other sources of information and communication aren't available [6]. As a result, mHealth could help public health dentists monitor far-flung locations, to remotely educate as well as, aid health extension workers to provide quality oral health care.

ROLE OF mHEALTH IN PUBLIC HEALTH DENTISTRY

mHealth in Outreach Programmes

India has achieved a dentist-population ratio of 1:5000 surpassing the ideal ratio of 1:7500 according to World Health Organisation (WHO) [7,8]. Yet, there is an imbalance in the dentist population ratio benefitting the urban areas, such that several rural villages, as well as communities in India are truly lacking in oral healthcare. Appropriate dental care at a primary health centre or community health centre can compensate for the lack of private dentists. mHealth is now being used to provide information and services to underserved communities, where other conventional mechanisms fail to deliver health services [9].

Mobile technology could be utilised for primordial, primary, secondary, and tertiary prevention. As a part of primordial prevention, a dental health awareness campaign could be conducted through text messages Short Messaging Service (SMS) and Multimedia Messages (MMS) on large scale [9]. According to a systematic review by Scott-Sheldon LA et al., rather than reading pamphlets, many prefer to read text messages supplied immediately to a mobile phone. Moreover, SMS are difficult to ignore, as the notifications keep coming until they are read and also can be retrieved at any convenient time [10]. Text messages emphasising the importance of quitting tobacco can, for example, be delivered to all mobile phone users, regardless of whether they are smokers or quitters [11]. When it comes to secondary prevention, screening of oral cancer is based on the idea that self-examination or an inspection by a healthcare professional decreases mortality and allows for early detection [9]. Oncogrid, a cell phone based virtual oral cancer surveillance technology, has been described by Birur NP et al., which connects primary dental care professionals with frontline health workers [11]. The use of mobile technology by community health workers in screening from home to home, health education, data collecting, counseling, as well as, referral has been proven to be effective [12]. According to Khan JG et al., social networking can be utilised to communicate where people from the community can socialise and discuss their needs and how to access the resources from the health system. Using the "Please Call Me" text messages, in which mobile phone users can send for free, the "Smile for You" campaign in South Africa identified potential beneficiaries to provide cleft palate surgery free of cost. A million "Please Call Me" texts were provided by the regional telecommunications provider Vodacom to enquire users whether, they knew of any children in need of this specialised procedure. A total of 42 kids were identified for surgery through this mHealth campaign [13].

A majority of respondents in an exploratory study by De Souza SI et al., believed that, mobile phones are feasible means of health

education. Therefore, mHealth offers an opportunity to promote a healthy lifestyle as well as satisfy the need for a feasible health education in the community [14].

Preventive Dentistry

- **Prevention of gingival and periodontal disease:** Oral health awareness and attitude in mothers of young children, plaque removal in orthodontic patients, and toothbrushing frequencies in unemployed youth have all improved because of text messaging from various mHealth interventions [15]. The mobile app 'Brush DJ' uses the idea of playing music to motivate users to brush for two minutes. Users may set alerts for brushing twice a day, using mouthwash at various times of day, changing their toothbrush every three months, as well as scheduling their next dentist appointment with the software [16]. Some of the other mHealth applications in dentistry include: Let's Brush Free, Moment of tooth, My Dental Care, MySmile, Oral-B App, Philips Sonicare, Quickbrush Toothbrush Timer, Smile- Dental Hygiene Analysis, Tooth Notes, ToothBrush Pacer, Toothbrush Timer, Toothy Brush Floss rinse, United Concordia Dental Mobile, My Smile, Do I Grind, Delta Dental, Bad Breath, Food For Teeth, My Dental Care. As reported by Tiffany B et al., in a heuristic analysis, some of the important features of these apps are tooth brushing timer, oral hygiene advice, oral health educational materials, oral hygiene alerts, monitoring of oral health behaviours, recording of dental visits, ability to communicate, and search for a dentist [17].
- **Prevention of dental caries:** Numerous studies in the review by Hujoel PP and Lingström P have demonstrated the association between food and dental caries [18]. Keeping tabs on a patient's diet is a common approach for determining their general health behaviour, as well as, the risk of developing caries. Journaling applications like Wellness Diary, My Food Diary, Calorific, Nutritionist etc., might enable simplifying this vital step of tracking diet history to prevent dental caries [9]. In a review, Chen R et al., noted a few features of high-quality apps related to diet and dental caries. These features included the provision of information about the association between dietary practices and dental caries, a diet diary that allows users to enter their food intake and time of consumption, and a traffic light grading system to nudge users toward low-sugar alternatives. The review also mentioned fluoride-related features, such as the provision of information concerning fluoride usage in compliance with national regulations and visual aids to display the amount of fluoride toothpaste that should be applied to the toothbrush [19].
- **Prevention of oral cancer:** The use of mHealth related interventions in cancer care can take many different forms, including the provision of digitally formatted information/education, the promotion of healthy lifestyle choices like regular exercise and vegetable consumption, and the assessment of symptoms that can range from pain to psychological signs of post-traumatic stress disorder, as well as symptom reporting [20]. As mentioned earlier, the incidence of oral cancer can be reduced by providing frontline health workers with mHealth technology connected to a specialist for early detection and screening in rural areas. The Biocon Foundation, in collaboration with the Government of Karnataka, launched the ambitious "screen and treat" mHealth programme designed to reach out to rural populations through existing healthcare resources and ASHAs [21]. A smartphone app called Prayaas Oral Cancer Prevention was created by Deshpande S et al., to provide information/education about oral cancer prevention and treatment [22]. In a scoping review by Dailah HG, it was found that despite differences in methodology, the chosen studies that reported the use of mHealth oral cancer detection revealed a generally positive correlation between clinical oral examination and remote diagnosis of suspicious oral lesions utilising various mHealth technologies. Some of the other oral cancer related mHealth interventions mentioned include: MeMoSa, Poi mapper, Cellscope, MobileNet and Oncogrid [23].

According to a trial by Gupta R et al., SMS could be a useful and low-cost delivery method for facilitating preventive health care. It has the potential for accessing a large number of people at a relatively minimum expense compared to conventional methods, which is an advantage for public health dentists [24].

Tobacco Cessation

Effectiveness and acceptance of SMS in the realm of smoking cessation have been established in several studies across various populations [25-27]. According to Jorayeva A et al., the use of text messaging combined with motivational interviewing resulted in a positive change in smoking behaviour. Most text messaging interventions were tailored to the users [25]. Text2Quit is a personalised, interactive smartphone app that delivers advice and alerts via text messages to aid in quitting the habit [26]. The "Happy Quit" delivers a series of text messages based on cognitive behavioural therapy concepts. The messages were designed to boost self-efficacy and behavioural ability to quit smoking [27].

Mobile applications also utilise behaviour change theories to aid in cessation of smoking habit. The application content comprises a database on the benefits of quitting the habit and motivates smokers to quit and plan for a cessation attempt. The process includes various techniques such as planning, monitoring, visualising and adapting to behaviour change. Scheduling a quit date, receiving push-notification, recording quit diaries, sharing features, email reminders, and prescribing theory based activities are also included to engage the smokers with the application content [1]. SmokeFree is a mobile app that provides smokers with behaviour change tools to help them achieve 28-day abstinence and track their progress. Acceptance and commitment therapy is provided by Smart Quit, which includes employing mindfulness techniques to cope with cravings, moods, and attitudes, as well as, making value-guided committed behaviour modification. Craving to Quit includes an ecological momentary assessment of smoking, craving and mindfulness, as well as, three classic mindfulness techniques along with an informal approach to identify and cope mindfully with cravings. Real e Quit (REQ-Mobile) based on social cognitive theory and the transtheoretical model delivers text messages with a few added features related to benefits of quitting and nicotine replacement therapy to aid in smoking cessation [28].

Tobacco cessation applications employ a range of features to encourage behaviour change. There are mobile applications that utilise gaming features like QuitGenius, Quittr and Crave Out [28]. The focus of public health dentists is continually evolving, and it can go, as far as, a professional's imagination, sense of duty, and efforts will allow. Therefore, a public health dentist does play a critical role to combat the tobacco epidemic by recognising patients, delivering health education, and making appropriate referrals through involvement in various tobacco cessation programmes [29].

Pandemic

Pre-screening, specimen collection, recording case histories, community participation, surveillance, and perhaps administration management of healthcare facilities are among the potential abilities of a public health dentist during a pandemic [30]. Most of these tasks necessitate contact tracing, which was greatly facilitated by mHealth. In many cases, we've progressed from a mHealth that was only utilised in pilot studies and/or was only tied to research to a mHealth that is now employed in everyday clinical applications and is controlled from every perspective. mHealth continued to play a crucial role during the pandemic in an impressive and incisive way to increase social distancing [31]. Many countries like China, India, Singapore USA and UK have used mHealth technology to control

pandemic/epidemic outbreaks. Novel COVID-19 had made the best use of mHealth technology through tele-consultation, real-time information for healthcare providers, and screening using the data collected across several locations [32].

Almost, every government on the planet has developed App-based solutions for contact tracing in digital form (DCT). Some governments have created national DCT Apps, while others have created local regional apps. Additionally, some have developed precise population monitoring apps, based on GPS, as well as, bluetooth-based protocols (voluntary membership) [31]. Public health dentists can work well in teams to collaborate with other medical professionals, lawmakers, local authorities, and researchers [30]. This team becomes especially important during pandemics when it is vital to trace contacts, consult contacts, and monitor the community. The use of mHealth by public health dentists to combat COVID-19 is recommended because the technology is relatively inexpensive, simple to use, readily available, and easily accessible. The mHealth applications in the public health aspect during pandemics outbreak include surveillance, contact tracing, public awareness, patient self-monitoring, notification in outbreaks, disease mapping systems and vaccine reminder systems. The other uses include data transmission between health centre, patient and public health education and disease testing for screening [32,33].

The ETZ treatment guide app, which originally provided information on breast cancer, cataracts, and other health conditions, was modified to include COVID-19 related information for symptom awareness and monitoring in Netherlands. COVID-19 Caregiver Cockpit, developed in Germany helps in screening COVID-19 patients [33]. ArogyaSetu app was launched by Government of India that uses both GPS and bluetooth technology for tracking. Similar technology was used for contact tracing in the app Trace together developed by Singapore Government. COVID-19 Safe, Immuni and Patch Check are contact tracing apps launched by Australia, Italy and the US, respectively. The NHS test and trace, UK used low energy Bluetooth technology and GPS in NHS COVID-19 app [34].

CHALLENGES OF mHEALTH

Limitations of mHealth include cost-effectiveness of internet based mobile interventions and also applicability of these interventions in varied population segments [11]. Poor connectivity and low bandwidth are some of the technical challenges faced in rural areas in India [12]. There is currently a plethora of non evidence based health apps in the market. Hence, people, who need the services the most are unlikely to download evidence-based apps unless they are aware of the scientific backing or believe it is superior to other existing apps. In addition, apps require continual resources for maintenance and update without which they become outdated and non functioning [35].

The major challenge includes ethical issues. Data is at the heart of mHealth technology, both in terms of how data is acquired and the quality and quantity of what is collected [36]. A Norwegian Non-Governmental Organisation (NGO) found that one health and fitness app along with nine other popular apps, shared data with advertising firms without user's authorisation, clearly violating general data protection regulation. Since the details on the usage of personal data were disclosed in an ambiguous form, the French data protection authority deemed google in violation of the protection of transparency [37]. The ability to restrict the recording and sharing of personal information with others is referred to as privacy. This necessitates the understanding of what will be recorded, how long it will be used, who will have access to it, as well as, the dangers of third-party exploitations [38]. Illegal or malicious access to confidential data has received much interest in debates about the ethics of mHealth [37].

mHealth technology largely relies on cloud computing, and numerous hacks have proved that, cloud storage is not secure. Unlike traditional health-care data storage, mHealth technology necessitates the collection and storage of potentially sensitive health information at the device level. In mHealth technology, patients or participants are provided access to their data, which poses a serious ethical dilemma. Patients are not typically provided raw data access in traditional care delivery models for many relevant reasons. Having a patient guess an uninterpreted X-ray or raw laboratory result invites confusion and potential distress. Patients who lack the necessary expertise and experience to understand the data they have access to will tend to frequently rely on online search engines and anecdotal evidence [36]. The majority of medical, health, and fitness applications may trade data with others, such as advertisers. Both clinicians and patients are increasingly using mobile apps as sources of information and decision making tools. Patients should be informed about these privacy hazards, which might be included in the app usage agreement [37]. Ethical issues can be solved to an extent by communicating the pros and cons of mobile health technologies with patients. Patients should be made aware of the possibility of third party gaining access to the data through hacking or legal interception or by telecommunication companies [38].

CONCLUSION(S)

mHealth apps in dentistry include apps that aid diagnostics, decision-making, behaviour change to improve adherence with established treatment pathways, digital therapeutic applications and apps designed to deliver health education. Moreover, public health dentists can execute mHealth technology at all levels of prevention in the public health sector. Additionally, mHealth can help public health dentists work together with other public health sectors, such as during pandemics. A fascinating advantage of successful mobile apps, that public health dentists can make use of is the possibility to favorably influence health on a large scale at a low cost, since smartphones are ubiquitous and extensively used. However, prior to implementing any mHealth intervention, the potential technical and ethical challenges should be weighed against the remarkable advantages. Future research should involve dentists, particularly public health dentists working with the app developers to create secure, user-friendly, and efficient apps to address these issues.

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