Recharging Smiles: Strategies for Using Mobile Phones in Dental Public Health

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Abstract: Through the advent of smartphones, the previously elusive internet is now available to each person right in their hands, with lightning fast speeds available at rather nominal charges. Mobile phones offer numerous solutions to dentists and health workers alike and can be applied in a variety of ways in a public health setting. This paper discusses the application of mobile phones in primary, as well as secondary and tertiary levels of intervention from a dental public health perspective. Indeed, the described strategies can be employed by professionals, alone or combined with other interventions, to enhance the oral health of their patients.

Keywords: cell phones, dental public health, health promotion, oral health, prevention.

Introduction

The role of communication in the human health care sector is inescapable. It helps to convey the patient's own experiences, values and preferences to the health care professional, all of which greatly influences a patient's perception of the service, can create motivation for change, as well as augment subsequent compliance and adherence.[1] This has led health care providers to constantly seek new, effective ways to reach "consumers" and promote their health through education, ultimately helping them manage their ailments. Overall, mobile phones have revolutionized the face of communication, and there is great potential for their use in health sectors. Patients and providers can now communicate from anywhere in order to follow-up on test results, ask questions, collect information, schedule appointments, send reminders and renew prescriptions.

Previously, text-messaging based health education campaigns have been used by administrations to control infectious diseases, to educate people regarding health policies, care of the pregnant and the elderly, and to dispel rumors.[2] In scarcely resourced countries, mobile technologies can be used in a three-fold manner – to educate health workers, to establish a surveillance system, and to provide information to the general public.[3]

Dental Public Health has been defined as "the science and art of preventing and controlling dental diseases and promoting dental health through organized community efforts. It is that form of dental practice that serves the community as a patient rather than the individual. It is concerned with the dental health education of the public, with applied dental research, and with the administration of group dental care programs, as well as the prevention and

control of dental diseases on a community basis."[4] In this new, complex world, dental public health is seen as a means to address the disparities in oral health outcomes that exist both within and between nations.[5]

In a country like India, where the dentist population ratio is so skewed in favor of urban areas, many remote villages and localities severely lack dental health services.[6] The absence of private dentists can only be countered by providing adequate oral health services at a primary health center or community health center. Deprofessionalization of dentistry has been regarded as a necessary evolution to combat the burgeoning morbidity due to oral diseases in rural areas, a problem that is only magnified by the ever-increasing population.[7] Developing a system to remotely educate and aid health extension workers will greatly improve the quality of oral health care. Where other conventional delivery mechanisms fall short, mHealth is already being used to provide underserved populations with access to information and services.

Mobile devices can easily be applied in a dental health setting to enhance patient outcomes.[8] As practitioners of dental public health in a developing nation where there is both lack of oral health awareness and lack of services, the authors realized the need for alternative methods of oral health care delivery. It was observed that most patients possessed a mobile phone with internet capabilities, and were also interested in innovative technologies that could enhance their health. This inspired a search for mobile phone interventions in dental public health. A comprehensive knowledge of the purposes for which mobile phones have been used in health-care in the past and an idea about their future utilization is necessary. Understanding the 'Why?', 'What?' and 'How?' of these interventions will enable public health workers to incorporate mHealth, an essential tool in this technology-oriented era, into dental public health practice.

Applying Mobile Phones In Dental Public Health
Researchers from all fields of science have attempted to incorporate the myriad features and technologies of mobile phones into health-care interventions. In the field of oral health, such interventions can be used in a variety of ways to enhance health outcomes. Dentists too are getting involved in this technological revolution. In a descriptive study by *Jasti et el.*,[9] approximately 68% of the surveyed dentists from Khammam, Andhra Pradesh reported using healthcare apps on their smartphones for either

personal knowledge or patient education purposes. In a Dental Public Health setting, mobile phones can be used for primordial, primary, secondary, as well as tertiary prevention.

In primordial prevention
One way to help patients is by giving them the information about how to avoid dental problems by means of text messaging or apps. A mass oral health education campaign can be carried out using text messages and multimedia messages (MMS) even before the appearance of risk factors in the population. For example, text messages discussing the importance of avoiding tobacco can be sent to all cell phone users, irrespective of their usage status. The reach of such a campaign will be massive because even in a developing country like India, there are approximately 74 mobile subscriptions per 100 people.[10]

An attempt can also be made to bolster the oral health of the community by taking advantage of the Digital India Initiative by the Government of India. '*Kilkari*' is one such scheme for information regarding maternal and child health, where pregnant women receive voice calls on a range of relevant topics.[11] Integrating oral health education into this scheme will not just expand the latitude of the existing programme, but will also allow access to a key target population.

In primary prevention
Using SMS and mobile phone applications, oral health education can be provided at an individual and community level. When selecting apps for oral health education, it is necessary to select one that dispenses accurate information based on evidence. Software developed for this purpose usually allows patients learn about their disease, its prevention and necessary treatment, however, requires active participation.

Smartphones can also utilize entertainment to dispense health education, such as *Molarcropolis*, a mobile persuasive to raise oral health and dental hygiene awareness for adolescents and young adults. *Soler et al.*[12] evaluated the game and found that most of the participants found the game to be both entertaining and informative. Mobile social media platforms such as Facebook and Twitter can also be used to leverage social influence and bring attention to the importance of oral health.

Schluter et al.[13] successfully utilized motivational text messaging to promote brushing among young

adults receiving Work and Income support in New Zealand. By making use of the communication capabilities of mobile phones, a discernible improvement in oral hygiene was obtained. Researchers have also reported that sharing anonymous photographs ("selfies") in a WhatsApp or other such chat-room leads to significant improvements in oral hygiene of participants.[14,15]

The *Brush DJ* app was developed to motivate patients to adopt an evidence-based oral hygiene behavior by playing music of the user's choice. The app also reminds the user to spit and not rinse after brushing in order to maintain optimum local fluoride levels. Its competence was demonstrated by *Underwood et al.*[16] who reported that 88% of app users were motivated to brush longer.

Dental caries is another common dental disease, closely associated with diet, as has been proven by innumerable researchers.[17,18] Tracking a patient's diet is a commonly used method for caries risk assessment and also for assessing one's general health behavior in routine practice. Although unexplored, this pivotal step of diet history can be simplified by making use of journaling applications such as Wellness Diary, Calorific, My Food Diary, Nutritionist etc. This comprehensive overview of the patient's diet history can be shared with the dentist who can then formulate an appropriate treatment plan.

To help patients quit harmful habits, public health dentists and primary care workers can provide habit counselling using mobile phones. An example of this is *The Real E Quit Mobile* smoking cessation application that helps people quit smoking with the aid of supportive audio clips and documents. Users can also make their own lists on reasons for quitting, benefits, and plans for challenging situations. *Buller et al.*[19] found that 75% of users evaluated REQ-mobile to be user-friendly, and concluded that it was a feasible method for delivering cessation support to help people quit smoking.

In secondary prevention

Oral cancer screening is based on the rationale that self-examination or oral check-up by a professional reduces the mortality due to this disease, and also leads to recognition in earlier stages. *Birur et al.*[20] describe the use of *Oncogrid*, a mobile phone based remote oral cancer surveillance tool, connecting primary care dental professionals with frontline health workers (FHW). This telemedicine program found that oral cancer screening and surveillance via mobile phones was feasible even in remote areas and low-resource settings. The authors suggest that such interventions can cause a paradigm shift in the practice of public health.

MySmileBuddy was developed by *Levine et al.*[21] to reduce early childhood caries prevalence and its consequences amongst a high risk population. It allows community health workers or lay workers to conduct preliminary dietary screening assessment for high risk children and their mothers. After collecting information on the caries risk, the parents are informed of suitable behavior goals they can choose from so that the caries risk is diminished. The associated community health worker also follows up on the family to assess the progress towards behavior goals. With further research and adaptation, the use of mobile technology for dietary assessment may be applicable for widespread use in a variety of sites and programs that address the health needs of young children. The highly-advanced cameras available in current mobile phones also allow for remote screening for dental caries by mid-level dental providers, as demonstrated by *Estai et al.*[22] They found that this method has a sensitivity ranging from 60-68%, and a specificity between 97-98%. This can help tackle some of the problems caused by the lack of dental services available to rural populations in countries like India.

Another problem created by inequitable distribution is the unavailability of emergency dental treatment. Oral and maxillofacial surgery (OMFS) is a particularly challenging field as it requires impeccable knowledge of both medicine and dentistry.[23] There is potential for gaps in clinical knowledge when an untrained health worker has to manage acute OMFS cases. Mobile devices can be a means to access electronic educational resources during clinical activities and also improve clinical decision-making.[24]

Additionally, it is now possible to advise even those who are furthest from dental treatment during an emergency. *Stein et al.*[25] developed an extremely useful application for the purpose of triaging dental emergency. Their study demonstrated that patients can use their smartphones to transmit relevant clinical data to their dentists, all within 4 minutes. The authors suggested using mobile applications to enhance routine and emergency dental care.

In Tertiary Prevention

In primary and community health centers, dentists are often posted on a rotational basis due to the

paucity of professionals. Therefore, a dentist may not always be available for post-surgery consultation. In the case of full-mouth rehabilitation cases, it takes quite some time for patients to get used to their new appearance and occlusion. To help patients rehabilitate, dental professionals and health workers can consult and counsel via mobile phones. For instance, *myDentist* is an app through which patients may explain their problems to the oral health care provider by sending text, diagrams or photos. The dentist can respond to these messages with appropriate instructions to manage the problem, and can also arrange an appointment for the future.

Dental phobia is a crippling disorder causing an individual to avoid dental treatment because of an irrational fear, even if they are in pain. In the process of avoiding the dentist, the disease progresses and may lead to severe disability. To limit this disability caused by dental diseases, elimination of dental phobia is necessary, after which patients can utilize the services available to them. Applications like *Dental Phobia* claim to reduce a patient's anxiety towards dental treatment through hypnosis. Such means of handling dental phobia must be critically

reviewed before wider application; research must be conducted in this field in the future.

Shortcomings of Mobile Phone Health Care Interventions

One of the primary restraints of mHealth is that not all interventions can be readily applied to the myriad segments of the population. It must be kept in mind that the ability to read the information may be lacking in many mobile phone users due to low literacy rates; approximately 15% of the adult population was considered to be illiterate in 2010. Moreover, as per World Bank estimates, at least thirteen developing nations have a literacy rate of less than 50%.[26] In such conditions, a text-based intervention may fail, while image-based interventions can succeed. Complicated and cumbersome technology may hinder, rather than assist the user, especially if the procedure involves too many steps.

Another limitation is that the cost-effectiveness of internet-based mobile phone interventions has not been established. Depending on the network carrier and data usage, charges can vary from user to user. One more feature that varies with network carrier is the range. Although there has been

Level of prevention	Problem	Intervention
Primordial prevention	Emergence of risk factors	- Using text messages for mass education - Integrating oral health education into 'Kilkari' programme
Primary prevention – Health promotion and specific protection	Poor knowledge about oral health	- Knowledge building through SMS and apps - Molarcropolis game - Social media
	Poor oral hygiene	- Motivational text messages - Selfies on WhatsApp/ WeChat based chatroom - BrushDJ app
	Poor dietary habits	- Diet tracking apps
	Deleterious habits	- Mobile smoking cessation app
Secondary prevention – Early Diagnosis and Prompt Treatment	Lack of trained personnel in rural areas	- Oncogrid - My Smile Buddy ECC risk assessment - Remote screening using mobile teledentistry - OMFS consultation and education - Oral examination smart chart
	Emergency / First Aid	- Dental emergency management app
Tertiary prevention – Disability limitation and Rehabilitation	Dental fear/phobia	- Anxiety management apps
	Post-surgery consultation	- Teleconsultation

Table 1: Mobile phone interventions in Dental Public Health

staggering growth, there are certain areas that are still untouched by this technology.

Additionally, *Tatum et al.*[27] have proposed that cortical processing in the human brain is uniquely activated by the use of personal electronic devices such as mobile phones. However, the practical and real-world implications are yet to be studied.

Finally, it is worth mentioning that there is a paucity of comparative studies regarding mobile phone interventions in dentistry. Therefore, it is not possible at this time to conclude on the relative value of each intervention. It is necessary to conduct rigorous investigation to assess the same.

Conclusion

Like fire and the wheel, the invention of mobile phones changed the lives of humans worldwide, and like most inventions, they are in a process of constant improvement. Healthcare professionals have recognized the impact this has had on the lives of their patients, and have adopted cellphones in a variety of ways. Oral health care providers can implement mHealth interventions in public health practice at all levels of prevention. Indeed, one, or a combination of these strategies can be employed by health workers to enhance the oral health of their patients. Moreover, mobile phones are an accessible, affordable, appropriate technology for interventions in a public health setting.

By focusing on prevention and involving the community in these programs, dental professionals can give a much-needed boost to the oral health status of people. There are unparalleled advantages to using mobile devices that cannot be matched by other technological media. However, the potential complications should be kept in mind. Dentists should take initiative and be involved in the planning of guidelines for these interventions.

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The literature search was performed using an electronic database search of peer-reviewed bibliographic and non-bibliographic databases, as well as a review of websites of reliable institutions. Medical Subject Headings (MeSH terms) were used wherever possible to ensure a uniform search strategy. Each term was used as a single item or in combination by employing the Boolean operators "AND" and "OR". The following terms were used: teledentistry, mHealth, mobile phone, mobile health, cell phone, texting, message, text message, mobile application, SMS, dentistry, dental health, dental public health, public health dentistry, oral health.

The studies that were not directed towards oral or dental health were excluded. All included studies focused on the prevention and control of oral diseases, collection and transmission of oral disease information, and training of health workers.

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