Mobile technologies for oral health: an implementation guide

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ISBN (WHO) 978-92-4-003522-5 (electronic version)
ISBN (WHO) 978-92-4-003523-2 (print version)
ISBN (ITU) 978-92-61-35121-2 (electronic version)
ISBN (ITU) 978-92-61-35111-3 (print version)

Suggested citation. Mobile technologies for oral health: an implementation guide. Geneva: World Health Organization and International Telecommunication Union, 2021. Licence: **CC BY-NC-SA 3.0 IGO**.

Cataloguing-in-Publication (CIP) data. CIP data are available at **http://apps.who.int/iris**.

Contents

Acknowledgements

The World Health Organization (WHO) and International Telecommunication Union (ITU) gratefully acknowledge the following contributors to this handbook.

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Layout and design

400 Communications, UK

Financial and in-kind support

Be He@lthy Be Mobile, University of Montpellier, France, University of McGill, Canada and Hilfsaktion Noma e.V.

Cover Photo credit

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Abbreviations and acronyms

AI	artificial intelligence
apps	(mobile) applications
BHBM	Be He@lthy Be Mobile
CDSS	clinical decision support system
CHW	community health worker
CIC	conversational interface chatbot
COVID-19	coronavirus disease
CPD	continued professional development
EOHR	electronic oral health record
GHz	gigahertz
ICT	information and communications technology
ITU	International Telecommunication Union
IVR	interactive voice response
M&E	monitoring and evaluation
mHealth	mobile health
MOOC	massive online open course
mOralHealth	mobile oral health
NCD	noncommunicable disease
NLP	natural language processing
PHC	primary health care
SDGs	Sustainable Development Goals
STEPwise	WHO STEPwise approach to Surveillance
TAG	technical advisory group
telecoms	telecommunications
VPN	virtual private network
WHO	World Health Organization

Glossary

Appropriate use of digital technologies	ICT that takes into account safety, ethical use, cost–effectiveness and affordability and is people centred, evidence based, effective, efficient, sustainable, inclusive, equitable and contextualized *(1)*.
Artificial intelligence (AI)	An area of computer science that emphasizes the simulation of human intelligence processes by machines that work and react like human beings *(1)*.
Digital divide	The gap between demographics and regions that have access to modern ICT and those that do not or that have restricted access. This technology can include the telephone, television, personal computers and the internet *(1)*.
Digital health	Used as a broad umbrella term encompassing e-health (which includes mHealth) as well as emerging areas such as the use of advanced computing sciences in big data, genomics and AI *(2, 3)*.
E-health	The cost-effective and secure use of ICT in support of health and health-related fields, including health care services, health surveillance, health literature and health education, knowledge and research. mHealth is a component of e-health *(3, 4)*.
E-learning	The use of ICT for education.
Evaluation	An episodic assessment of either a completed or ongoing programme or intervention to determine the extent to which its stated objectives were achieved efficiently and effectively.
Global Oral Health Agenda	The WHO Global Oral Health Programme promotes a global agenda for achieving better oral health as part of WHO's noncommunicable disease and universal health coverage, thereby contributing to the achievement of the United Nations 2030 Agenda for Sustainable Development. The mOralHealth programme is one of these priorities jointly developed with the WHO–ITU Be He@lthy Be Mobile initiative and supporting Member States to improve oral health worldwide.
Health literacy	Implies the achievement of a level of knowledge, skills and confidence to take action to improve personal and community health by changing lifestyles and living conditions. By improving people's access to health information and their capacity to use it effectively, health literacy is critical to empowerment. Health literacy itself depends on more general levels of literacy. Poor literacy can affect people's health directly by limiting their personal, social and cultural development as well as by hindering the development of health literacy *(5)*.
Interoperability	The ability of multiple ICT systems and software applications to access, exchange, integrate and cooperatively use data in a coordinated manner through the use of shared application interfaces and standards, within and across organizational, regional and national boundaries, to provide timely and seamless portability of information and optimize health outcomes *(1)*.

Information and communication technology (ICT)	Refers to technology that provides access to information through telecommunications technologies, which encompasses the internet, wireless networks, cell phones, computers, software, middleware, videoconferencing, social networking and other media applications and services that allow users to access, retrieve, store and transmit information in a digital form.
Machine learning (ML)	A subset of AI that allows computer programs to learn without being explicitly programmed. These programs learn from data sets, identify patterns within them and use the information to make predictions about data they have not been previously exposed to *(6)*.
mHealth	A subset of e-health that uses mobile and wireless technologies to support health objectives, including providing health care support to patients or technical support to health service providers in a direct, cost-efficient and engaging manner *(3, 7)*. mHealth involves the use of and capitalization on a mobile phone's core utility of voice and SMS as well as more complex functionalities and applications, including general packet radio service, third- and fourth-generation mobile telecommunications (3G and 4G systems), global positioning systems and Bluetooth technology *(7)*.
Monitoring	Routine tracking of an intervention's performance using data collected internally on a regular and ongoing basis on specified indicators. This information is used to assess the extent to which an intervention is achieving its intended targets on time and on budget.
Teledentistry	Uses ICT for dental consultations, diagnosis and treatment planning, including the transmission of clinical information and images between an oral health professional and patient or between two health professionals, including at least one oral health professional, who are separated by distance *(8)*.
Telehealth	The delivery of health care services where patients and providers are separated by distance. Telehealth uses ICT to exchange information about the diagnosis and treatment of diseases and injuries, for research and evaluation and for the continuing education of health professionals. Telehealth can contribute to achieving universal health coverage by improving access for patients to quality, cost-effective health services wherever they may be. It is particularly valuable for those in remote areas, vulnerable groups and ageing populations *(4)*.

Executive summary

Almost 97% of the world's population lives within reach of a cellular network, and the number of mobile phone subscriptions has been growing steadily over past decades *(9)*. Building on the widespread use of cellular phones and similar technologies, mobile health – or mHealth – approaches have emerged using mobile technologies for health-related interventions. The World Health Organization (WHO) and the International Telecommunication Union (ITU) have partnered to promote the use of mobile technologies to address the burden of modifiable diseases. The joint initiative Be He@lthy Be Mobile (BHBM) provides guidance on delivering disease prevention and management information through mobile technologies directly to specific target groups, including individuals, communities and health care professionals, to strengthen health systems. In line with strategic objective one of the Global Digital Health Strategy, BHBM promotes global collaboration and advances knowledge transfer on digital health.

Oral diseases affected about 3.5 billion people around the world in 2017, untreated dental caries in permanent teeth being the most prevalent condition. Severe periodontal disease is widely spread and is a major cause of total tooth loss *(10)*. Cancers of the lip and oral cavity are among the 15 most common cancers worldwide *(11)*. Other lesser known oral diseases such as noma also have significant health, social and economic impacts in some regions, resulting in high mortality and disabilities in those affected. Among the most common congenital conditions are cleft lip and palate, which require early and complex surgical interventions and rehabilitation. Similar to other ailments, oral diseases primarily affect the poorest, most disadvantaged and most socioeconomically marginalized populations. Oral diseases considerably affect health, well-being and quality of life across the life course, especially where resources for prevention, diagnosis and treatment are limited.

Approaches based on new technologies, such as mHealth, can be used to promote oral health as well as to prevent and control oral disease. Against this background, the mOralHealth programme was jointly developed by the WHO Global Oral Health Programme and the BHBM initiative. It aims to contribute to the achievement of better oral health as part of the 2030 Sustainable Development Agenda, including universal health coverage (UHC), as well as to tackle the burden of noncommunicable diseases (NCDs).

The mOralHealth programme comprises four key modules addressing a range of target groups.

1 

The mOralHealth literacy module aims to improve the oral health literacy of individuals and communities as well as raise awareness of and advocacy for oral health priorities among policy-makers, decision-makers, the media and civil society organizations (CSOs).

2 

The mOralHealth training module encourages using mobile technologies for e-learning approaches to enhance the knowledge and skills of general health professionals as well as expand awareness of priority oral health interventions for oral health professionals.

3 

The mOralHealth early detection module provides information on the potential of early detection by using remote diagnostics tools to improve timely treatment and facilitate access to and improve quality of health care services.

4 

The mOralHealth surveillance module informs about the use of mobile technologies in the context of oral health surveillance and collection of epidemiological data as well as monitoring of quality patient care and service delivery.

These modules are designed as flexible components that can be implemented individually or collectively, according to a country's specific needs. Similarly, the mOralHealth programme can be implemented as a stand-alone intervention to improve oral health or be integrated into existing initiatives targeting other NCDs.

This handbook provides guidance for developing and implementing an mOralHealth programme to support respective target groups in preventing and controlling oral diseases, maintaining good oral health, and improving well-being and quality of life. It is intended to assist policy- and decision-makers and implementers to realize a national or large-scale mOralHealth programme. It describes how an mOralHealth programme can be used to complement existing initiatives and health system responses.

The handbook starts by providing background information on mHealth, the BHBM initiative and the burden of oral diseases as well as more details about the handbook's structure. It then describes the operational management of an mOralHealth programme, including executing a needs assessment, building leadership and partnerships, conducting formative research and developing a workplan. The following chapter specifies how to develop and adapt content to the national context for each of the four modules. The next chapter on promotion, recruitment and dissemination shares insights into how to raise awareness of target groups to enrol in the mOralHealth programme. The nature of an mHealth programme requires the setup of a technological environment; the chapter on technology specifications refers to technical aspects that need to be considered. Finally, considerations for monitoring and evaluation (M&E) are addressed as essential components of the mOralHealth programme to ensure its relevance and effectiveness for improving oral health.

Introduction

1 Rationale for mHealth

It is estimated that in mid-2020, 96.7% of the world's population lived within reach of a cellular network: 99.6% in developed, 96.1% in developing and 88.9% in least developed countries. Averaged globally, there were more mobile phone connections than people, with 105 subscriptions per 100 inhabitants in 2020.

These averages differed among the regions, with 82.3 cellular telephone subscriptions per 100 inhabitants in Africa compared to 98 in the Arab States, 104.6 in Asia and the Pacific, 122.7 in Europe, 148.2 in the Commonwealth of Independent States and 110.9 in the Americas *(9)*.[1] Although rates vary by country and region, it is estimated that 76% of the world's population owns a mobile phone: 92% of those in developed countries and 56% in the least developed countries. Gaps in access among population groups and regions, also referred to as the *digital divide*, do exist, but the spread and increasing trend of new technologies, particularly mobile phones, make this platform a key modality for delivering health-related interventions.

Mobile health, or *mHealth*, refers to the use of mobile technologies for health-related interventions. Mobile phones, tablets and other mobile devices and digital technologies are used to deliver information, training and access to health services. There is growing evidence for the use of mHealth using tools such as text messaging, video messaging, phone calls, mobile internet, mobile applications (apps), visualization and diagnostic tools, and monitoring devices. mHealth has been successfully used across a range of health areas, including public health education and telehealth, chronic disease monitoring, medication and treatment adherence, patient–provider communication and behaviour change intervention *(7)*. Because of the high adoption of mobile phones and diversity of mHealth interventions, mHealth has the potential to reach population groups in remote and low-resource settings or where barriers to accessing health care exist *(12)*. It provides a unique tool to be used by individuals and health care professionals at opportune times and locations *(13)*.

Mobile technologies can strengthen health systems, communities and individuals to manage health more effectively and can improve the delivery of health services. By providing motivation and knowledge to empower people to make better choices, tools for health professionals to expand knowledge and skills, new technologies for detecting oral diseases across distances and the means to monitor and evaluate the impact of policies on population health, mHealth technologies may have a profound effect on how health services are delivered and how health systems are run *(14)*.

Thorough preparation and planning are key, and certain considerations and prerequisites need to be taken into account. Ensuring a person-centred approach will help to focus on the needs and circumstances of the person rather than just the condition or disease. Similarly, involving key stakeholders in the planning process and accompanying the implementation with appropriate change-management measures are crucial to ensuring acceptance of mHealth interventions by the target population or users, such as health care providers and patients. A critical element of mHealth interventions involves taking measures to ensure confidentiality and ethical storage of data as well as interoperability and integration with current digital health information and services.

1 ITU country classifications available at: https://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx (accessed 4 January 2021).

By providing access to health information and services to people who did not have access before, mHealth can reduce inequalities. Depending on the intervention, it may also exclude some groups of people, such as those who are not literate or who communicate in a language not covered in the intervention and those who don't have access to mobile technologies. Therefore, particular attention needs to be paid to these excluding factors in order to not increase health inequalities or marginalize certain groups.

There has never been a more relevant time to invest in mHealth than now. The COVID-19 pandemic, which started at the end of 2019, presents the greatest global challenge to the delivery of oral health care in decades. The role of technologies in the health care response to the pandemic and, indeed, in connecting people, communities and services more generally has come to the fore. There is a need for promotion and prevention measures to reduce further burden on stretched health care systems and to use remote consultations in primary health care (PHC) to maintain patient and provider safety and reduce costs.

With the increasing presence of mobile phones in everyday life, mHealth has the potential to improve and complement the delivery and support of health care and public health, including disseminating information rapidly and widely, empowering patients and reaching diverse population groups.

2 The Be He@lthy Be Mobile initiative

The BHBM initiative is a global partnership jointly led by WHO and ITU and representing the United Nations agencies for health and information and communication technologies (ICT), respectively. The initiative provides technical expertise and supports countries and governments to use mHealth within national health systems to help combat noncommunicable and modifiable diseases like diabetes, cancer, cardiovascular diseases, chronic respiratory diseases and oral diseases, as well as their risk factors.

The BHBM initiative develops operational guidance to help countries and governments to implement mHealth programmes, supporting the first strategic objective of the global digital health strategy: promoting global collaboration and knowledge transfer on digital health. The programme-specific handbooks are central tools providing relevant information to aid policy- and decision-makers and implementers of national or large-scale mHealth programmes.

3 The burden of oral diseases and their impact

In 2017, more than 3.5 billion people suffered from oral disease. Untreated dental caries in permanent teeth was the single most prevalent condition, affecting 2.3 billion people worldwide. Untreated dental caries of primary teeth affected 530 million children. Severe periodontal disease, a major cause of total tooth loss, is estimated to impair 796 million people, particularly older adults *(10)*. Cancers of the lip and oral cavity are among the 20 most common cancers worldwide. In Melanesia and South Asia, they are the leading cause of cancer-related deaths among males *(11)*. Other lesser known oral diseases also have significant health, social and economic impacts. Prevalent in some African and Asian countries, noma results in high mortality or lifelong disability of the children affected. It is a devastating and necrotizing disease that starts in the mouth and is a marker of extreme poverty. Cleft lip and palate are among the most common congenital conditions and require early and complex surgical interventions and rehabilitation.

Similar to other ailments, oral diseases primarily affect the poorest, most disadvantaged and most socioeconomically marginalized populations. Inequalities relating to oral health can be observed both within and between countries. Oral diseases also account for a large economic burden *(11)*, not only as direct costs related to treatment but also as costs due to loss of time in the workplace or at school. Unequal distribution of oral health professionals and lack of access to appropriate facilities for vulnerable populations living in deprived communities or remote areas result in most oral diseases going undetected and therefore untreated.

Oral diseases share common risk factors with other NCDs, particularly unhealthy diets rich in free sugars, tobacco use and harmful alcohol consumption. Reducing risk exposure and applying simple protective measures can significantly reduce the burden of oral diseases. Strategies to improve oral health through policy as well as through community- and clinical-level disease prevention and management approaches can therefore be integrated with and used to strengthen interventions targeting other NCDs across the life course.

4 What is an mOralHealth programme?

Based on the burden of oral diseases and the potential of mHealth, the WHO Global Oral Health Programme, as part of the joint WHO–ITU BHBM initiative, made the development of the mOralHealth programme one of its priorities. The main aim is to support Member States in improving oral health worldwide in the context of attaining the Sustainable Development Goals (SDGs), including the achievement of UHC, with a basic package of oral health care. At the country level, an mOralHealth programme is intended to complement, support and strengthen implementation of a national oral health policy or interventions using mobile and digital technologies.

In the area of oral health, mHealth is a growing sector, and mHealth interventions have demonstrated significant potential *(15, 16)*. (See **Annex 1** for examples of mHealth programmes promoting oral health.) Against this background, mHealth approaches may be implemented and further strengthened to help promote oral health. While mHealth provides great opportunities, it also entails challenges to employ mobile technologies in a way that ensures everyone benefits and that inequalities in health and oral health are reduced instead of contributing to further widening the gap and leaving people behind. Where there are existing mHealth and digital health programmes, interoperability of the mOralHealth programme also needs to be considered.

The mOralHealth handbook comprises four modules spanning different target groups and intervention areas as illustrated in **Fig. 1**.

1

The mOralHealth literacy module aims to improve the oral health literacy of individuals and communities as well as raise awareness of and advocacy for oral health priorities among policy-makers, decision-makers, the media and civil society organizations (CSOs).

2

The mOralHealth training module encourages using mobile technologies for e-learning approaches to enhance the knowledge and skills of general health professionals as well as expand awareness of priority oral health interventions for oral health professionals.

3

The mOralHealth early detection module provides information on the potential of early detection by using remote diagnostics tools to improve timely treatment and facilitate access to and improve quality of health care services.

4

The mOralHealth surveillance module informs about the use of mobile technologies in the context of oral health surveillance and collection of epidemiological data as well as monitoring of quality patient care and service delivery.

All modules are complementary and mutually enhancing. Each module can be implemented as a stand-alone intervention or in combination with other modules. The scope of the mOralHealth programme largely depends on the country context, existing health systems, needs of potential target groups and available resources, among other aspects.

FIG. 1.

The four complementary modules of the mOralHealth programme, their target audiences/groups and their goals

1 mOralHealth LITERACY

Individuals and communities
- Improve oral health literacy

Policy-makers, the media and civil society
- Promote oral health advocacy

2 mOralHealth TRAINING

Health workers
- Increase oral health knowledge and skills

Oral health professionals
- Expand awareness of the global oral health agenda

3 mOralHealth EARLY DETECTION

National health system
- Innovate on early detection of oral diseases

4 mOralHealth SURVEILLANCE

National health system
- Strengthen population oral health surveillance
- Monitor quality patient care and service delivery

The four modules making up the mOralHealth programme vary with regard to the scope and level of guidance and detail provided. mHealth literacy programmes in different areas, including oral health, have been implemented widely, and as a result, more information, experience and evidence are now available on those. For the modules on training, early detection and surveillance, this handbook provides general guidance and considerations complemented with experience from case studies. These three modules hold great potential, and countries are encouraged to use the existing guidance and then share their experiences and learnings with the BHBM team.

4.1 Module 1: mOralHealth literacy

Mobile technologies, particularly mobile phones, are increasingly being used to access health information. Several mobile-based solutions exist to improve access to information and knowledge and to foster behaviour change to improve health.

The mOralHealth literacy module is designed to empower individuals and communities to access, understand and apply information to help them maintain good oral health. It builds on the momentum of the SDGs' emphasis on health promotion.

Focusing on the individual and community level, the mOralHealth literacy module gives basic essential information on promoting oral health and preventing oral diseases. By employing behaviour change techniques like motivational and supportive messages as well as reminders, the literacy module encourages individuals at all ages to perform healthier oral health behaviours.

Alongside individuals and communities with limited oral health knowledge and support, the mOralHealth literacy module aims to raise awareness and advocate for the importance of oral health among influential groups. These particularly include policy- and decision-makers, the media and CSOs. Their influence may contribute to increasing the development and implementation of effective policies based on the global oral health agenda and reaching different population and societal groups. A comprehensive summary of an mOralHealth literacy module is provided in **Table 1**.

Text messaging is well suited for public health interventions due to its low cost, vast reach and ability to be tailored and personalized. To date, text messaging has been the most extensively researched form of mHealth intervention, with the majority of health interventions based on text messages showing evidence for positive impacts on behavioural or health outcomes and cost–effectiveness *(17–21)*. Other forms of interaction, such as through mobile apps, also present avenues to disseminate information and motivate people to perform healthy oral health behaviours *(22)*.

In a time of information overload and the spread of fake news (see **Box 1**), an mOralHealth literacy module can be used to counteract misinformation among the public by disseminating knowledge and evidence-based information.

TABLE 1.

Overview of the mOralHealth literacy module

mOralHealth literacy		
	Literacy for individuals and communities	**Literacy for other groups (Policy-makers, the media and nonstate actors)**
Aim	Improve oral health literacy and increase good oral health behaviour of individuals and communities	Promote oral health advocacy by policy-makers, media and nonstate actors
Implementers	Governmental bodies (local, national), public health agencies, academia, CSOs, etc.	Governmental bodies (local, national), public health agencies, academia, CSOs, etc.
Target audience/ groups	• general population • parents and teachers as intermediaries to reach children • adolescents • pregnant and lactating women • persons with specific needs (ageing persons, persons living with physical and/or mental disabilities)	• dental public health officers • decision- and policy-makers • the media • consumer and patient associations • CSOs • national dental associations • other non–oral health professionals
Potential technologies	SMS, voice messages, messages on social networks, smartphone apps, etc.	Messaging for health, social media, apps, etc.
Potential outcomes	Improve knowledge and supportive behaviours through accessing, understanding and applying information to maintain good health, specifically: • increased awareness of common risk factors for NCDs (tobacco, betel/areca nut and khat/qat use; harmful use of alcohol; unhealthy diet rich in free sugars) • improved knowledge, attitudes and skills regarding oral hygiene, including fluoride toothpaste and healthy diet related to free sugars • better understanding of the advantages of preventive, safe, early, minimally invasive and environmentally sound oral care • improved knowledge of access to oral health care	Improve awareness and understanding of and access to oral health–related information in order to advocate for better oral health through: • developing and implementing effective oral health policy • stopping fake news in oral health by publishing real news • fighting against counterfeit medicines and oral hygiene products • advocating for fiscal policies that promote effective and affordable oral hygiene products • making the financial case to increase budgets for oral health • supporting UHC initiatives that include oral health care and prevention measures • disseminating oral health information based on best available evidence
Potential impacts	Improved ability to engage in self oral health care, manage diseases and access health care systems and effective oral hygiene products	Oral health better prioritized in national public health policy

BOX 1:

Fake news in oral health

The internet is an important source of oral health information for many people. However, the internet and social media are also used to circulate fake news. *Fake news* refers to deceptive information in which facts are (wilfully) distorted or falsified, the scientific evidence is lacking or the message contains quasi-scientific results. Social media, in contrast to traditional media, is largely uncensored. Quoting, sharing or liking fake news on social media channels can disseminate the false information rapidly and widely without any checking or validation mechanism to ensure information quality. As a result, information with a varying degree of accuracy exists. This makes it more difficult for users to navigate the internet to find health-related information that is evidence based.

Exposure to fake news can influence people's decision-making process and consequently mislead them to make choices with negative health impacts. It is therefore important to encourage people to verify the information they find online, enable them to identify evidence-based health information and guide them in identifying and interpreting health information *(23)*.

An example of widely shared fake news is the harmful effect of fluoride in toothpaste. This misinformation can convince people to switch from a fluoride to a biological (nonfluoridated) toothpaste, which may increase the risk of tooth decay.

One way to counteract fake news is to disseminate evidence-based health information. The mOralHealth literacy module can be used to spread evidence-based oral health information to various target groups.

4.2 Module 2: mOralHealth training

Training in oral health, as in other areas of health, is becoming more and more digitized. Using mobile technologies to inform, support and build capacity in the area of oral health can be an important way to empower health professionals and also contribute to improving the quality of care, particularly in PHC and people-centred and integrated health care. mHealth may also contribute to addressing the ongoing challenges of workforce shortages and access to medical education more broadly, thereby strengthening health systems.

The mOralHealth training module aims to 1) increase the oral health knowledge and skills of general health professionals, particularly frontline health workers, including community health workers (CHWs), and 2) expand awareness of priority public health interventions and the global oral health agenda among oral health professionals. The details of an mOralHealth training module are summarized in **Table 2**.

TABLE 2.

Summary of an mOralHealth training module

mOralHealth training		
	Training for general health professionals	**Training for oral health professionals**
Aims	Increase oral health knowledge and skills of health professionals, particularly frontline health workers as well as CHWs	Expand awareness of oral health professionals on global oral health and prioritize oral health interventions
Implementers	Ministry of Health (MoH), health education institutes, public health agencies, universities	MoH, health education institutes, public health agencies, universities
Target audience/ groups	medical doctors, nurses and PHC workers	dentists, dental assistants, dental nurses/hygienists and other oral health professionals
Potential technologies	SMS, social networks, smartphone apps, web platforms (e-learning)	SMS, social networks, smartphone apps, web platforms (e-learning)
Potential outcomes	Improve knowledge and skills of health professionals (e.g., frontline health workers) by: • providing information on oral diseases and their risk factors • improving management of oral diseases • enhancing prevention of oral diseases • increasing the implementation of programmes to promote oral health • improving early detection, diagnosis, and treatment of oral diseases, such as noma, oral submucous fibrosis and oral cancer	Improve oral health professionals' awareness of the priority of oral health interventions by: • sharing evidence about major common risk factors for oral diseases and other NCDs as well as best practices, key public health strategies and cost-effective interventions • fostering interprofessional collaboration, task shifting and service integration towards UHC • improving knowledge of the global oral health agenda (e.g., Minamata Convention, mOralHealth programme)
Potential impacts	Improvement of integrated, person-centred oral health care at the primary care level	Improvement of integrated, person-centred oral health care and population-based preventive interventions

4.3 Module 3: mOralHealth early detection

The mOralHealth early detection module aims to use mobile technologies to improve early detection of oral diseases such as oral cancer and noma. An example of an mOralHealth early detection intervention is the use of telemedicine to provide oral examinations and diagnose oral diseases remotely, such as in rural communities and/or communities with issues accessing oral health care. Remote detection and diagnosis can also be used in combination with physical oral examinations. Studies show that a combination of conventional (face-to-face) oral examination and digital technology assistance improves the accuracy and quality of early diagnosis of some oral diseases *(24, 25)*.

Early detection increases the chances for timely, effective and successful treatment by focusing on identifying symptomatic and asymptomatic patients as early as possible. Recognizing signs of oral diseases early, facilitating diagnosis and enabling prompt action can improve disease management and outcomes. Delays or restrictions in accessing health care are common, particularly in remote areas, lower resource settings and vulnerable populations. The consequences of delays in accessing health care are decreased survival, greater burden of disease (i.e., disability) and higher mortality rates. In such a context, early diagnosis aims at reducing the proportion of individuals who are diagnosed at a late stage and at providing care at the earliest possible stage. Applying mobile technologies to remote detection and diagnostics in oral health can redirect interventions from a dental practice to another setting. PHC and health systems are transformed towards a more people-centred and integrated model of health service delivery through interventions like mHealth, telehealth and remote care *(14)*.

Based on current knowledge and experience, there is a potential for mobile technologies to support remote access and consultation for early detection and referral to services for treatment and disease management. Further innovation development, testing and evaluation are needed.

Although these technologies have been shown to improve the timing and quality of screening, they cannot yet be applied sustainably on a global level. This is particularly the case in areas that face socioeconomic, cultural and geographical barriers. Any intervention inherently needs to be adapted to the context and setting in which it is to be used to achieve effectiveness.

The details of an mOralHealth early detection module are summarized in **Table 3**.

TABLE 3.
Summary of an mOralHealth early detection module

mOralHealth early detection	
Aim	Improve and increase early detection of oral diseases, facilitation of diagnosis and treatment planning and/or referral to services for treatment and disease management
Implementers	MoH, central hospitals, public health agencies, public and private insurance providers at the central level, CHWs, nurses, medical doctors/physicians, frontline health workers at the primary care level
Target audience/ groups	Populations at risk (e.g., older adults, people living in remote areas, children at risk of noma, people at risk of oral cancer, tobacco and/or alcohol consumers)
Potential technologies	Mobile phones, tablets, intraoral camera, SMS, apps, telemedicine systems, virtual private network (VPN)
Potential outcomes	Improve early detection of oral diseases by: • sharing and improving the knowledge and skills of health professionals needed to detect oral diseases in an earlier stage • creating interprofessional collaboration among frontline health worker, CHWs, medical professionals and referral services with medical/dental specialists • strengthening a referral pathway of early detection of oral diseases (e.g., noma and oral cancer) between primary care and referral health facilities • improving oral health awareness and access to care, improving oral health literacy and reducing stigma of oral diseases and anxiety about treatment
Potential impacts	• Increased rate of referral and improved early management of oral diseases • Reduced proportion of individuals who are diagnosed at a late stage • Decreased morbidity and increased quality of life related to oral diseases • Reduced mortality rates caused by oral diseases, particularly oral cancer and noma • Integrated teledentistry activity in local/regional/national policy

4.4 Module 4: mOralHealth surveillance

Public health surveillance enables the identification of disease trends and informs public health policy- and decision-making on adequate policy interventions based on oral health information and epidemiological data. mHealth interventions can make a valuable contribution to surveillance systems. They can be used to facilitate and expand data collection, accuracy and timeliness.

The mOralHealth surveillance module aims to use mobile technologies to support a wider integrated national health surveillance information system for meaningful, interoperable and coordinated data collection. The data collected will contribute to monitoring and measuring progress. It can help to evaluate the (1) health status of the population based on epidemiologic data, (2) health service activities, (3) disease management, (4) treatment and health outcomes, (5) associated costs and (6) public health interventions.

Public health surveillance guides the development of oral health policy and strategies based on information about the incidence and severity of disease, health services costs, and preventability and feasibility of prevention and control *(26)*. When this information is routinely collected, stored, reported and analysed, public oral health policies are much more likely to be tailored, effective and relevant to the population.

A summary of the details comprising a mOralHealth Surveillance module is provided in **Table 4**.

TABLE 4.

Summary of an mOralHealth surveillance module

mOralHealth surveillance		
	Population-based surveillance	**Health service delivery surveillance**
Aims	Collect and analyse oral health epidemiological data in the population to inform and guide oral health policy development	Monitor oral health care activities and service delivery of the health system and promote oral health–related epidemiological data collection
Implementers	MoH, researcher/academia, oral health epidemiologists, oral health professionals	MoH, national health insurance providers, national dental associations, private and public health care providers, researcher/ academia; those working to improve the quality of health service delivery
Target audience/ groups	Policy- and decision-makers at MoH, public and private care providers, the population, patients	Policy- and decision-makers at MoH, national health insurance providers, public and private care providers, facility quality improvement teams, researchers, development agencies, patients
Potential technologies	Mobile phones, digital cameras, smartphones, laptops, web platform, apps and tablets connected to a database, servers or cloud, electronic health record with an integrated oral health surveillance system	
Potential outcomes	• Improve availability of epidemiological oral health data on the incidence and severity of oral diseases in the population • Provide information on the population's behaviour, knowledge, attitude and perception of oral health	Monitor health care activities and service delivery of the oral health care system by: • maintaining a national database of oral health care facilities in the different health care sectors • strengthening routine health facility reporting • collating existing resources that facilitate quality improvement in service delivery, including facility infrastructure and equipment, workforce availability, drugs and medical devices • providing information on costs of oral health services
Potential impacts	Inform and guide oral health policy and strategy development. Prioritize oral health in public health policy, and develop health care promotion, guidelines, policies and legislation aimed at creating safer environments to help prevent oral health conditions and diseases.	Improve the availability, functioning, accessibility, affordability and quality of oral health care and health outcomes

1

Operations management

This chapter describes key activities that need to be considered during the planning and preparation phase of an mOralHealth programme, including:

- developing a workplan
- conducting a needs assessment
- doing formative research
- setting up programme leadership
- establishing partnerships.

1 Operations management

1.1 Workplan development

Developing a workplan is essential to guiding and keeping track of the various steps prior to and during the implementation of an mOralHealth programme. Table 5 provides a checklist for developing the workplan, which can be adapted as necessary to the specific needs of any country. The five sections of the workplan are not consecutive and should be completed in parallel.

TABLE 5.

Checklist for developing an mOralHealth programme workplan

Operations management
For this section, you will make planning decisions, create a description of the programme and develop an operations management plan that specifies who will be responsible for implementing the project and for ensuring provision of the services.
○ Conduct a needs assessment.
○ Do formative research.
○ Establish programme leadership and partnerships.
○ Develop an overall description of programme management.
Content development and adaptation
Based on the needs assessment, you will develop or adapt the content of the selected module(s) for this section. A research-driven refinement process should also be implemented.
○ Review existing programme content and rules of implementation.
○ Review existing technology (devices and systems).
○ Conduct a risk assessment of areas of the project that are vulnerable to delay or budgeting issues and make a risk management plan.
○ Adapt content (e.g., text messages, training materials), systems and service specifications.
○ Ensure a fully functioning and tested system.
○ Plan for updating content and systems.
○ Pretest and refine the programme.

Promotion, recruitment and dissemination

For this section, you will make decisions about marketing of and enrolment in the programme.

- Develop a promotion and recruitment plan (launch, short-term, mid-term and long-term strategy), with roles, activities, timelines, targets and a budget.
- Get to know the target groups.
- Identify barriers regarding implementation and adoption of the programme.
- Identify promotional strategies.
- Identify a recruitment method.
- Develop a strategy for dissemination.

Technology

For this section, you will make decisions about the necessary infrastructure and rules for the programme.

- Determine the type of mHealth technology and channels to be used (SMS, apps, teledentistry, etc.).
- Research availability of technology options within the public and private sectors.
- Decide on a process for procuring, adapting and maintaining technology.
- Develop a dashboard and rules for access to it.
- Negotiate with telecommunications (telecoms) regulators, aggregators and operators for pricing.
- Ensure data security.
- Pretest technology and make scale-up plans.
- Create public–private partnerships: appropriate contractual arrangements with the best providers, and plans to ensure long-term sustainability.

Monitoring and evaluation

For this section, you will decide what indicators the programme will measure, how to measure them and with what frequency.

- Develop an M&E framework and plan.
- Select relevant methods and indicators.
- Identify evaluation questions.
- Collect data.
- Plan for dissemination of results.

1.2 Needs assessment

For an mOralHealth programme to be effective, it is essential to understand the context in which the interventions will be delivered and the needs of the target groups and users. Conducting a needs assessment, including a readiness assessment, is a prerequisite to getting a better understanding of the setting. The needs assessment follows a systematic process for collecting relevant information for planning, identifying gaps in resources, knowledge and skills, and informing decision-making.

It also helps to determine the relevant barriers and facilitators of behaviour change within a country's context. The needs assessment should be conducted in an iterative way during which stakeholders are encouraged to identify sources of information and additional stakeholders. The results of the needs assessment will inform the development and implementation of the mOralHealth programme and help establish baseline measurements from which the programme can be monitored and evaluated. **Table 6** lists the considerations for conducting a needs assessment.

TABLE 6.
Recommended considerations for an mOralHealth needs assessment

Topic	Considerations
Current situation of oral health	• What are the public oral health problems (e.g., mortality, morbidity, burden of oral diseases, incidence and prevalence across population groups disaggregated by age, sex and location for different oral diseases and conditions)? • What are the risk factors of oral diseases? • What are the social determinants and inequalities in access to services and oral health outcomes? • What are the national priorities for oral health? • What are the national guidelines for oral health? • What are the population knowledge levels, cultural attitudes, perceptions of risk, current behaviours and behaviour trends? • What are the workforce knowledge levels, cultural attitudes, perceptions of risk, current behaviours and behaviour trends?
National response and provision of oral health care services	• What existing national oral health policies are in place? • What are the national priorities of the government and the health system? • What existing national oral health programmes are in place? • What are the objectives, constraints, institutional and human resources, and available funding? • What are the limitations of services, training, equipment, treatment, supplies and resources? • What are the scope and uptake of current oral health services, including integration into UHC? • What is the capacity of the oral health workforce? • What is the level of training? • What training and quality assurance systems are in place?

Topic	Considerations
Oral health services and health care infrastructure	• Which oral health services and health care facilities are available? • To what extent does the population have access to oral health services and health care providers? • What are the referral and monitoring systems? • Is oral health integrated into general health care services, particularly for NCDs?
Target audience/ population	• Which groups should be primarily targeted regarding oral health literacy, training, early detection and/or surveillance? • Are there specific regions/communities with higher risk or burden/need? • What are the target groups' characteristics, including size and demographics? • What are the opportunities and challenges within the target groups? • What are the access barriers for the respective target groups?
Contextual, geographical, cultural and behavioural influences	• Are there any contextual, geographical, economic, cultural or behavioural influences that should be considered (e.g., attitude, access to oral health services, religion, language, literacy, technology)? • What are individual and cultural attitudes to oral health care and self-management? • What are cultural and social factors that may influence individuals from adopting a healthier lifestyle? • What are the motivations and incentives for individuals and groups to participate in an mOralHealth programme? • Who could be considered trusted champions, and how could they be leveraged? • What are the most appropriate forms of interactions with target groups (e.g., SMS, web, app, interactive, etc.)? • What are the expected costs and who will pay them?
Level of mobile communication	• What is the existing ICT capacity? • What are the level of mobile communications, statistics on mobile device access and use, available networks and costs? • Are there any regulatory restrictions on mHealth intervention? • Are there any cultural considerations around communication via mobile technologies? • What technology platforms does the population have access to (e.g., SMS, social networks like Facebook, instant messenger services like WhatsApp)? • Is there widespread access to the internet on mobile devices?
Legal considerations	• What is the regulation and legal framework on medical data management? • What is the regulation and legal framework on telemedicine/teledentistry? • What are the privacy and security regulations and legal frameworks? • Who could be involved in data collection? • Do you need consent to send people messages or provide telemedicine and teledentistry? • What is the capacity for each health profession involved in the programme regarding oral health?

Topic	Considerations
Stakeholders	• Who are the relevant stakeholders (agencies, organizations, donors, companies, experts, target populations) to be involved in the programme planning, development, implementation and M&E, and what are their interests? • Potential stakeholders may include: ◦ national and subnational/regional levels of public health institutions/ experts ◦ funders of public health services ◦ MoH and other relevant government departments and agencies ◦ private and other health care workers who work in oral health ◦ government agencies responsible for telecoms and data protection ◦ telecoms companies, mobile network providers and industry bodies or associations ◦ any local mobile phone service providers or companies that provide (or have previously provided) mHealth services in any area of health ◦ patient associations and community advisory groups ◦ health insurance companies and other private sector supporters ◦ academic researchers (public health, oral health, NCDs, behaviour change, social marketing, mHealth) ◦ academic/training institutions. • How do these stakeholders see an mOralHealth programme and the facilitators and barriers? • What are the needs/wishes of the stakeholders?
Digital oral health technologies	• How many effective and evidence-based apps on oral health are available? • Are teledentistry services available? • Are other digital oral health solutions available? • Is there a digital health department in dental school faculties the national dental association or oral health department of the MoH?
Promotion	• What channels will be used to promote the mOralHealth programme? • How can people register for the programme? • What recruitment strategies will be used? • What are the incentives for participation?
Further research	• Are there other areas in which further research is required to facilitate a successful mOralHealth programme? • Is any further formative operation research needed?

Sources of information may include:

- public health records
- (un)published records/surveillance data on prevalence/incidence disaggregated by age, sex, oral disease and condition, location and socioeconomic status
- public health officials
- oral health care workers
- other health care professionals
- people with oral health conditions and their support people
- telecoms companies, official records and publications, and mobile service end users
- oral health workers' association
- dental association
- literature and scientific publications
- private sector companies
- academic institutions.

The results of the needs assessment form the basis for prioritizing the modules of the mOralHealth programme, as well as its content and focus. If the needs assessment does not provide the required information, it may be necessary to conduct further formative work and/or research.

1.3 Formative research

In the case of insufficient or outdated information from the needs assessment, formative research may be required. This can include conducting online surveys and/or focus group discussions with the target group(s), key stakeholder interviews or pilot studies. The purpose of formative research is to provide information prior to or during programme development to inform or modify the programme to address the needs, preferences and priorities of the target group(s), determine whether there are any vulnerable populations who have special access needs and decide how best the programme can be integrated.

Academic partners should be sought to be involved in this formative research. The international informal expert group established by WHO could be also engaged in this part.

1.4 Programme leadership

To facilitate planning, implementation, monitoring and evaluation of an mOralHealth programme, a leadership team or steering committee should be established with clear roles, responsibilities and accountability. If other mHealth programmes already exist, the steering committee on mOralHealth could be integrated if appropriate. Sharing resources and experiences among different mHealth programmes is strongly advised, as this may create synergies, save effort and promote alignment and integration. **Fig. 2** suggests how to set up the leadership groups.

FIG. 2.

Proposed structure of an mOralHealth implementation team

National mOralHealth steering committee

This committee ensures agreement on the general direction of the programme and assists in decision-making as well as fosters partnerships.

- Includes representatives from the Telecommunications Ministry or equivalent, MoH and/or other ministries that provide oral health care, support or activities
- Puts mechanisms in place to formalize a clear governance structure and functions (terms of reference, meeting frequency, roles and accountability) and to set out programme responsibilities

National technical advisory group (TAG)

This group comprises high-level experts to support in-country project teams.

- Includes expert advisers from government sectors (including health, business, social security, treasury and planning), telecoms, the technology and software industry, local mobile network providers, regulatory and privacy experts, nongovernmental organizations (NGOs), health professionals, health and social care professionals, health economists, academic and research organizations, health insurance groups, health service providers, civil society groups, opinion leaders, patients and the media
- Supports programme implementation and promotion by assisting and advising the operations team (see next group)

Operations team

This group runs the programme, establishes the budget and sets deadlines; it reports to WHO and donors.

- Includes a project manager plus two to three people to help with day-to-day programme operations
- Engages with and maintains strong programme partnerships
- Can include additional technical advisers (permanent or ad hoc) such as ICT specialists, public health and disease topic specialists and communications specialists (for content adaptation and marketing and recruitment); M&E officers can advise the team from the outset

International advisory group

This group advises on technical and legal issues, the choice of platforms for scaling up and sustainability and feasibility issues.

- Includes WHO (country, regional and headquarters offices), ITU and the informal expert group that produced the BHBM handbook (note: even if a country does not opt to receive BHBM technical assistance, its status as a stakeholder should remain to ensure coherence with BHBM and for collecting and disseminating lessons learned)

1.5 Programme partnerships

Forming partnerships is an essential component of developing an mOralHealth programme, and identified partners are closely involved in all phases of the programme, from planning and development to implementation and evaluation. They include the government, CSOs (such as patient organizations and professional societies), the private sector (telecoms organizations, technological companies and insurance companies), academic institutions, NGOs and international organizations. Box two provides some lessons learned from BHBM's extensive experience in working with diverse partners.

BOX 2:

Lessons learned from BHBM partnership management

Multisector dialogue: In Senegal and Sudan, BHBM, through a digital platform supported by ITU, became the first health care initiative that increased the country's technical capacity with regard to mHealth. From the beginning, it brought together the public and private sector by inviting all telecoms companies to join forces.

Alignment with public value: *Public value* refers to how value is created through a partnership among the private, public and third sector to meet everyone's basic needs. To design future strategic partnerships, members of BHBM need to align themselves with a larger societal purpose such as improved well-being of society. In Senegal, alignment with a social purpose resulted in a flat partnership structure where all mobile providers joined forces, regardless of market competition, power position or previous market share, resulting to an increased level of trust among all sectors. Aligning partnerships with a social purpose has also attracted long-term investment from the private sector.

Empowerment of civil society: In both Senegal and Sudan, civil society – especially the patient groups and diabetes associations – demonstrated a creative approach to solving a social problem by actively searching for new innovations and bringing partners together through an open dialogue. Members of civil society, such as patients' groups, own more power than previously had been considered and could hold the key to establishing future strategic partnerships.

Service-based innovation ecosystem: Developing a long-term view on partnership and placing a digital platform at the heart of BHBM has led to some spillover benefits. Best practices from India, Senegal and Sudan highlight how a digital platform has the potential to enable an array of emerging services and form a serviced-based ecosystem, which could help to sustain BHBM on a country level.

2

Content development and adaptation

This chapter gives oral health promotion planners a framework for developing and adapting the content of each module of an mOralHealth programme.

2 Content development and adaptation

2.1 Developing or adapting an mOralHealth literacy module

Experience shows that despite the best efforts of health experts to craft appropriate content for a global audience, programmes are critically improved by target user-driven processes to refining the programme content and mode of delivery.

This section of the handbook will provide guidance on:

- identifying target users of the standard content library
- adapting the design of the mOralHealth literacy module to the respective country context
- adapting the existing BHBM mOralHealth literacy content library to the country context
- creating additional content for the mOralHealth literacy module if the content provided is not sufficient to the needs.

Text messages are the most equitable modality for delivering health messages, particularly in resource-restricted settings (where much of the population may not have access to a computer or a smartphone). Therefore, BHBM suggests that countries run SMS programming alongside other technology options like messenger apps or stand-alone apps if they wish to deliver the programme through smartphones. See **Annex 4** for guidance on adapting the content library to other formats (e.g., voice and messenger apps and chatbots) and adding multimedia.

Whether you are adapting an existing content library of the mOralHealth literacy module or creating new evidence-based content, the national TAG should review any existing mOralHealth prevention and management programmes and guidelines that may guide the development of programme content. In both cases, target users should be involved to test the understandability and clarity of the message content and design and to provide essential insights for validating and finalizing the programme design and content.

The BHBM team encourages all countries that have adapted the mOralHealth literacy module to share any additional messages or content with the BHBM secretariat to enhance and inform further iterations of the global content libraries and to share with other countries that can potentially benefit.

2.1.1 Target audience/users

The content library has been developed based on the scientific literature, United Nations publications and policy statements and guidelines of professional organizations. The message library currently contains oral health messages across nine topic areas (e.g., oral health behaviours, diet, consulting a dentist, smoking) that can be adapted to country contexts and message delivery platforms for the following four main target groups:

1. parents and teachers as intermediaries to reach children from 3 to 9 years old
2. adolescents from 10 to 19 years old
3. pregnant and lactating women
4. persons with specific needs (e.g., older persons, persons under cancer treatment or persons living with diabetes or other physical or mental disabilities).

2.1.2 Design and adaptation of the programme framework

When designing a framework for an mOralHealth programme, the TAG seeks behaviour change techniques (BCTs) and practical strategies to effect oral health behaviour changes of individuals or communities and/or to change organizational and environmental factors. The BCT taxonomy

gives an overview of existing techniques (see BCT in the app store or visit **https://www.bct-taxonomy.com/**). A practical strategy is a way of organizing and operationalizing the BCTs. For example, the BCT "providing information about health consequences" can be translated as a practical strategy: "provide information via SMS messages on how sugar consumption can cause dental diseases".

As text messages have been proven to be an effective application for providing oral health information and thereby promoting oral health, the WHO developed an mOralHealth text-message library. The mOralHealth literacy content library includes a set of one-way messages for different target groups. This standard content library is available on request for countries to use as a basis for an mOralHealth literacy module (see **Annex 2**). The messages have been written in SMS format but are adaptable to other mHealth technologies.

BHBM suggests running the module for a minimum duration of three months, as habit formation takes an average of 66 days *(27)*. The proposed algorithm starts at a higher frequency of messages, which diminishes over time. Several behaviours are targeted simultaneously to keep the module from becoming uninteresting; however, evidence does not show that simultaneous is more beneficial than consecutive behaviour change. The module splits the population based on a number of characteristics to better tailor the content to the respective target groups.

There is flexibility for countries to choose to not adopt all recommendations of the module, run the module for a longer or shorter period, adjust the number of messages to make the module more or less intensive or adapt the system rules (such as length, message frequency and timing, etc.), registration, opt-in/out and other functions.

When adapting the mOralHealth literacy module, the following should be considered and guided by feedback from target users of the module:

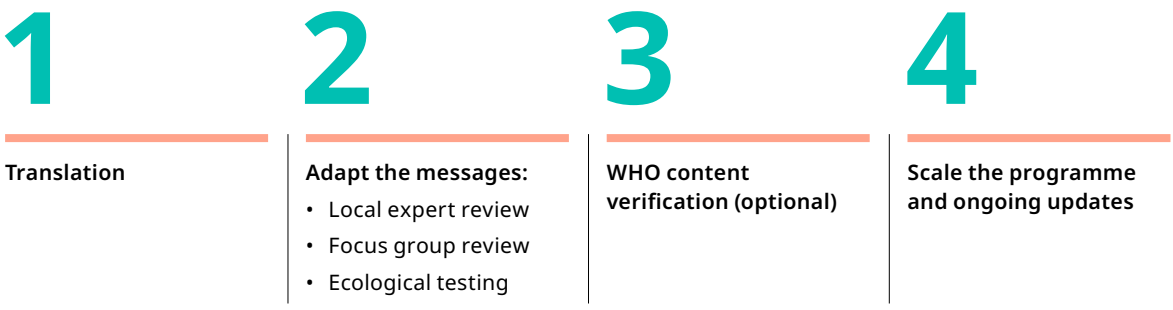
- media and channels used
- timing, frequency and duration of the intervention
- collection and storage of baseline and accumulating research data
- registration, opt-in and opt-out process and administrative communication (if any)
- mode of communication/interaction (one- or two-way interaction)
- degree of choice and flexibility in how messages are received
- possibility of stopping and/or changing the programme
- extent of interaction with clinicians or the health service system.

2.1.3 Existing content and its adaptation

International experts in oral health, mHealth and health communications were involved in the process of developing the mOralHealth literacy content library. Messages were drafted based on WHO guidelines and other scientific evidence. The content has been written with the understanding that the messages should be adapted for country use and we suggest a process like that outlined in figure 3. Adaptation is important to ensure that the information is clear and relevant to the target population. Target groups need to be able to relate to the content and have the means to apply the behaviour change strategies in order to improve outcomes and ensure retention of users. In other words, the messages must be understandable, acceptable and relevant to the people using them to increase their impact.

FIG. 3.

Overview of the suggested adaptation process



2.1.3.1 Translation

The first step of adaptation is translation. The original message library must be first translated into the local language(s). Sensitive translation is essential so that the messages are clear, engaging and linguistically sensitive. When translating the programme content, it is important to consider the choice of languages and dialects.

The choice of languages is critical to ensure that the target groups are able to access the programme. Experience running BHBM programmes and feedback from users have reiterated the importance of this. For example, in Tunisia implementers found that the programme must be available in Arabic as well as French for it to be taken up. In India the team learned that having at least Hindi in addition to English was crucial to obtain more subscriptions.

In countries where there are multiple dialects within languages, it is important to explore which dialect will be most acceptable to the most people or whether the programme must be available in more than one dialect. When considering dialects, consider spoken versus written or classical forms of the language: for example, would writing in the spoken style of Arabic be more engaging for users than classical written Arabic?

Once translated from English to the local language, the translation should be back-translated into English again by a different translator (one who has not seen the original English content) to check its accuracy. This does not need to be a professional translator but can rather be a person who speaks and reads both languages. If there are discrepancies between the original and the back-translated English versions, the two translators and the implementing team can discuss the best alternatives to provide a sensitive and accurate translation into the local language.

The choice of languages is critical to ensure that the target groups are able to access the programme.

2.1.3.2 Adapting the messages

Local experts and target users should be involved in the adaptation process leading to a contextualized library of messages (or other content, such as chatbot scripts or app content). Messages need to be easy to understand, unambiguous, appropriate and relevant to the target users. Their inputs can be gathered through review processes and qualitative methods, including focus groups, surveys and user pretesting. This can be done by a trained expert in the mOralHealth programme or a contracted specialist market research company.

In the provided mOralHealth literacy content library, some words are written in red font to show where surface or superficial adaptations will likely be necessary in country (e.g., replacing food items with local foods or activities that are context or culture specific). It is important to note that adaptation should not be limited to these words. Other parts of the message (or whole messages) may also need to be adapted. The challenge is to maintain the scientific accuracy of the message while making it relevant to users in a local context. For example, fish is suggested in some programmes as a source of protein and omega-3. If fish is very expensive or unavailable in the local context, it will be necessary to change it to another appropriate food containing omega-3 and protein, such as nuts and seeds. Another example may be to adapt a suggestion to exercise by walking; in the case that it is unsafe or too hot to walk outside, suggest instead to do some exercise in the home.

The process of adapting the message library may involve the following steps to ensure a user-centred, cost- and time-balanced approach.

2a. Local expert review

Local experts in oral health, including academics, PHC workers, health communications specialists and behavioural scientists, can be invited to send their review of the adapted and translated messages. They may complete the review for free if they are acknowledged in the programme reporting and related materials. If you have the resources, you can host an initial adaptation workshop in person or online for these experts to meet and discuss their review. These specialists should have a background in behaviour change and/or health promotion in the field of oral health. It is important to ask them during this review if additional content should be developed (see **Section 2.1.4**). Incorporating the feedback from this review should result in a draft local content library. The next step is to validate the messages through the target population.

2b. Focus group review

Focus groups with end users can gather feedback on the understanding, perceptions, opinions, beliefs and attitudes towards the messages. Although this step can be resource intensive, many BHBM countries have found that it is worth the investment. This phase can involve a small number of in-person or virtual focus groups with target users and health workers (e.g., five groups of 8–10 participants). If necessary, some focus groups could be replaced with telephone interviews.

The focus group should include persons representative of the target population, with geographic diversity (rural, urban, different districts or regions nationwide), linguistic diversity (regional dialects), diverse socioeconomic backgrounds and different cadres of health workers (if they constitute the target population). When composing focus groups, group dynamics and cultural norms need to be considered; for example, is it appropriate or may it inhibit participation in the discussion if elders are mixed with youth or if groups are mixed gender or hierarchies? The goal is that the group should feel comfortable and disinhibited in participating. Focus group participants may be recruited through community message boards or local community events, social media or health centres. The latter should be used only if really needed as the results may be biased if using persons already engaged with health services. Remunerating the time of the participants needs to be considered, and informed consent to participate needs to be obtained for ethical reasons.

The goal of the focus groups is to verify whether the programme content is:

- understandable (Do users understand the concepts and terminology used in the content library? Are the terminology and phrasing clear and unambiguous for the target groups?)
- acceptable (Are the messages respectful of and sensitive to the local context and inoffensive?)
- relevant (Are all the messages necessary and applicable to the environment and context of the user? Will people engage with the messages?).

Focus group discussions can also be used to find out more about user preferences for the timing (e.g., mornings, common break times, etc.) and frequency (e.g., once a day, every second day) of the messaging/intervention as well as the level of engagement that can be expected in the case of using apps or chatbots.

The project team should review findings from the focus groups and then make changes to the content library and programme as needed. It is important to document the changes made and the rationale for the changes for future reference. This information is also valuable to the BHBM secretariat for making improvements to the mOralHealth literacy content library and understanding more about its global relevance and use.

2c. Ecological testing

Ecological testing refers to testing the programme content in a way that mimics the conditions in which the programme will ultimately be delivered and received by the users. Receiving the messages on a mobile phone during a normal day is different than sitting down to read a list of messages on paper or in a presentation in a focus group. Although time- and resource-consuming, ecological testing is important and can go a long way towards overall programme success. Ecological testing may be done in a small group of potential users or via real-world pilot testing. For small-group testing, it is recommended that you test the sign-up process and the programme messages (or app or chatbot) for one to two weeks with a small group of participants (approximately 15) and ask them to rate each message (or session) immediately as they receive it, providing feedback on the acceptability and helpfulness of the message. For example, you can ask testers:

- "How did you find the sign-up process on a scale of 1 (being very easy) to 5 (being very difficult)?"
- "Please estimate how long in minutes it took you to sign up (approximately) and reply with the approximate number of minutes."
- "How much did you like the message on a scale of 1 (very much) to 5 (not at all)?"
- "How helpful was this on a scale of 1 (very useful) to 5 (not useful at all)?"
- "How likely would you be to implement the suggested advice or instruction in the message on a scale of 1 (very likely) to 5 (not likely at all)?"

Ecological testing could also involve real-world pilot testing. In the example of mTobaccoCessation Tunisia, the team deemed user testing and piloting as "essential". When conducting real-world consumer testing, the adapted programme is sent live to a group of participants as part of a soft launch or pilot study. This is similar to programme scaling, with the same dose and frequency of messages (or interactions), although over a shorter period of time if resources are restricted (e.g., the first two months of the programme instead of the entire six months). The group is surveyed over the telephone periodically during the course of the pilot, mainly to determine how understandable, acceptable and relevant the messages are, but also how likely they would be to engage in the suggested behaviour change. The results are then used to refine the programme.

2.1.3.3 Optional fidelity checking of the adapted content

The international expert group who contributed to the original content library of the mOralHealth module is available for reviewing the adapted and contextualized version (back-translated, English-language) of the content library before widespread use in a particular country context. The request may be sent to bhbm@who.int, and the team will arrange for a review by the expert group.

2.1.3.4 Scale the programme and ongoing review and maintenance

Many countries choose to carry out a small soft launch or pilot of the programme as part of real-world consumer testing. This process can also test the appropriateness of the evaluation mechanism and indicators. This Phase 1 programme evaluation will likely gather qualitative feedback from users, which can be used to further adapt the content library, even after Phase 1 implementation has begun.

Finally, the national TAG must finalize and agree on a plan (including who is responsible) for maintaining the database of programme content (such as messages or chatbot scripts) for updates (e.g., to incorporate updates from BHBM or updated national clinical guidelines, etc.).

2.1.4 Development of additional content

The process for creating the content library of the mOralHealth literacy module is comprehensive, with it being linked to other areas of the global oral health agenda and in close collaboration with an international expert group. However, it additional material may be required for the selected target groups.

To assess whether additional content is needed or whether the BHBM mOralHealth literacy library is sufficient, consider the following questions:

- Are there any groups or subpopulations that are not served by adapting existing BHBM content?
- Are there any popular values or beliefs around oral health specific to the target groups that warrant additional programme content?
- Are oral diseases highly stigmatized?
- Are there special informational or oral health management needs resulting from a high prevalence of related diseases and conditions that are not already covered in the mOralHealth literacy content library?
- Are the rules of the BHBM mOralHealth literacy content module (e.g., the frequency and duration, interactivity, etc.) inappropriate for the target groups?

If any of the previous questions are affirmed, first clarify if potential content from other health communications campaigns exists. If not, try to gather as much information as you can about the details in order to create the new content. You will need to gather opinions of specialists in the health topic area to develop new content.

When developing the content, it is important to take into account the following aspects, so that messages (or app content or chatbot scripts) are understandable, acceptable and relevant to the users:

- language, tone and clarity of the health messages
- health literacy and technological literacy level of the target groups
- ensured provision of information, concrete instruction for self-managed behaviour change, reminders and motivational content
- consideration of and potentially tailoring to specific groups (e.g., healthy populations, rural or urban populations, socioeconomic status, ethnic group, age, gender)
- salience and utility of practical tips and strategies for the population
- avoiding an alarmist tone or negative framing to behaviour change messages (if a negative framing is used, be sure to provide an instruction, solution or hopeful statement as well to avoid causing anxiety and a feeling of disempowerment in the user)
- an “active” component, or an “ask,” is included (e.g., a statement that asks users to act)
- whether the information should be static or dynamic, depending on whether the programme is uni- or bidirectional or fully interactive via a chatbot or an app (based on input from the user)
- length of characters per message allowed in each country or the data implications of sending the content (more applicable to images and videos).

Research shows that there are "mediators of meaning" when developing written messages, which go beyond basic tailoring of messages to different cultural settings *(28)*. These mediators help explain the hidden assumptions related to culture, health and the health system, which may be interpreted through health communication messages. Maar et al. *(28)* found that there are six main themes or factors that influence the level of congruence between the message content that researchers perceive to send versus the content that is perceived by the recipients. See **Annex 3** for a summary of the relationships between the main themes, the operationalizing strategies and the affected behaviour change conditions, which will be helpful to consider when composing the messages *(28)*. New content should then be user tested with target users as outlined in **Section 2.1.3.2**.

2.2 Developing an mOralHealth training module

Health care systems worldwide are challenged by a shortage of health care professionals, and this trend is expected to increase. This shortage also applies to oral health professionals. Unequal distribution and lack of appropriate treatment facilities further contribute to a situation where most of the oral disease burden (particularly tooth decay) remains untreated. Advances and innovations in education technology, including mHealth as a tool to deliver training and education, offer a way to address these challenges. The health sector has adopted e-learning approaches as one of the key strategies for health workforce training as well as for continued professional development (CPD) to expand and better equip the existing health care workforce. Although e-learning has many advantages, it should be noted that it cannot completely replace training, diagnosis and treatment by oral health professionals. However, it may complement and contribute to existing services and improve referrals.

2.2.1 Target users

Using e-learning approaches may increase access to learning opportunities for various target groups at scale as well as those that are geographically remote or have no link to training facilities. E-learning gives health professionals the opportunity to access to or refresh their oral health knowledge and skills in a flexible and efficient way *(4)*. Engaging oral health professionals in the wider health and oral health area on national and international levels, priority oral health interventions and dental public health knowledge may have the potential for significant contributions to both NCD and oral health agendas.

The main target audience for mOralHealth training programmes should be people directly in contact with communities such as general health professionals, particularly frontline health workers, doctors, nurses and CHWs. In many countries, frontline health workers are often the first and only contact for patients within the health care system. With their medical background and training, they are potentially well-suited to also address basic oral health matters, such as oral health promotion, oral disease prevention and, with appropriate training, even basic treatment. CHWs are often an essential element of and access point to the PHC system. In their scope of work, CHWs provide first aid, health education and referrals. E-learning measures may therefore provide an opportunity for them to enhance their oral health knowledge and skills. These measures may also make tools (e.g., checklists, decision tools, etc.) available on mobile devices to general and particularly to frontline health workers in order to expand access to and improve quality of care. Several public health e-learning interventions are available, all proven to be effective in reducing common risk factors and promoting oral health.

The mHealth literacy module (as described in **Section 2.1**) can contribute to the mOralHealth training module, which in turn can be linked to the mOralHealth early detection module to train target groups in employing early detection technologies or to the mOralHealth surveillance module to provide training on improving or implementing surveillance.

2.2.2 Designing a training module

Prospective training courses for both target groups should ideally ensure quality, neutrality and credibility of content. The background and context of training providers should be considered in order to be aware of possible bias. Employing a reputable, accredited platform or institution is critical for increasing credibility and trust. Using information based on evidence and scientific literature and regularly updating content will strengthen transparency and relevance.

E-learning tools should be easy to locate and access and should meet the needs of target users. Certificates, credits for CPD or similar recognition may be considered to provide users with incentives to enrol, complete the training module and apply acquired knowledge and skills. Alignment with international and national strategies, policies and programmes is essential to mainstream content and messages and to avoid confusion and misinformation. Being aware of the limitations of e-learning courses in terms of additional knowledge and skills of learners is key to keep expectations and activities realistic and safe. Training courses should be evaluated in terms of learners' experiences and course outcome and impact.

It is important that potential target users are involved in the development process of any mOralHealth training module. Evidence has shown that there needs to be high perception of utility of the training for target groups (e.g., facilitating access to knowledge and saving time and money) and ease of use for success. Additionally, interactivity within programmes is highly valued, in the sense of easy contact with tutors and other colleagues and tutorials available on the web for guidance and feedback. Therefore, in addition to providing fast and inexpensive high-quality knowledge in a convenient format tailored to the learner's expectations, tele-education initiatives should consider how human interaction and feedback are taking place (e.g., webinars, email, live chat, video, simulations, virtual content).

Although e-learning has many advantages, it should be noted that it cannot completely replace training, diagnosis and treatment by oral health professionals.

An international data bank of training sessions in oral health may offer considerable value. If every country shares its web platform on training oral health, we could have an important and global platform of content that could be used by every Member State. An international expert committee could validate the content to make sure that only factual information will be disseminated.

Several considerations should be taken into account when designing an mOralHealth training module.

Quality content and alignment with national policy context

First and foremost, the content of an e-learning measure should provide evidence-based or evidence-informed information and have undergone some sort of review and assessment by (a group of) experts or a public authority to ensure its quality. Information also needs to be independent of commercial bias.

Ideally, an e-learning measure needs to be maintained by regular revisions and updates based on new scientific research results. If a course carries a recent time stamp or update notice, its relevance may be improved for learners. Adding modules over time to reflect new developments, learnings and emerging knowledge enhances the overall relevance of the course.

Content of e-learning measures should be aligned with national policies and programmes and be culturally and contextually appropriate. Ensuring this may require further efforts for local adaptation.

Integration with existing health professional trainings and accreditation

There are different ways to promote participation in mHealth-related trainings and e-learning measures. They can be standardized trainings integrated into existing preservice education and/or in-service training. They can be made mandatory for specific health care professionals or offered voluntarily to those who are interested.

Available courses may be developed together with or reviewed by respective national institutions in order to receive national accreditation. Ideally, they are officially recognized by MoHs or other institutions so that they can be used for meeting CPD criteria.

Awarding CPD or any other form of recognition for engaging in additional efforts provides incentives for participation and completion. Giving incentives to health care workers as well as oral health professionals to access e-learning for oral health promotion, oral disease prevention and dental public health is crucial for creating need and demand as well as retention. Incentives may include certificates of completion or credit points for CPD as well as making the training mandatory in the job description or for promotion.

Using the platform of a credible and respected institution

The credibility of the content also depends on the institution providing the e-learning measure, which in turn may be an incentive in itself (i.e., a course carrying the WHO or a WHO CC logo may have higher credibility and hence better

participation). Therefore, it is important that e-learning measures are provided by institutions that are considered credible, respected and legitimate. They also need to be transparent with regard to their objectives, structure and funding. There should be no hidden agenda or bias. Ideally, e-learning measures would have to adhere to minimal requirements based on national or international standards to ensure full transparency of funders, developers and sources used as well as a number of other criteria.

E-learning measures should be located or linked to a national or international institution that is credible and known in the health sector to easily locate it and to counteract isolated approaches and fragmentation. This could also be a platform that provides a meta site, which accumulates available high-quality e-learning resources in a structured way. The platform should be easy to locate online by those who are interested in or who need to take mandatory CPD courses. Existing networks and platforms for respective oral and general health care professionals, such as professional bodies or associations, could also be used to promote participation.

Accessibility and modality

Ideally, e-learning tools are freely accessible to learners or available under a minimal cover charge to ensure affordability and access for those with limited resources. Carefully consider the question of whether to charge fees: there is often a perception that free content is not worth anything. This perception must be balanced against the credibility of the hosting institution or provider.

E-learning can be given in an asynchronous matter by providing course materials and prerecorded lectures or videos to be accessed by the learner at their time of convenience. E-learning can also be made synchronous by convening at a certain time online, presenting course material, providing remote online peer tutoring for clinical skills training and so forth.

Also consider where learners are located and if barriers such as low bandwidth could prevent them from accessing content. Preloading or downloading videos to address streaming difficulties in areas with slow internet speeds can be an option.

Massive online open courses (MOOCs) are established ways of delivering courses on all kinds of subjects in various sectors for learning new skills and enhancing existing ones. Accessed online using computers or mobile devices such as smartphones, MOOCs are flexible tools with the potential to reach learners at scale.

Virtual reality (a 3D simulation) and augmented reality (a superimposed image onto an existing object) are now being used as tools for training dentistry students as well, with good learning outcomes *(29)*.

Content design and methodology

Not only the content but also the pedagogical approach are important and should be learner friendly. Employing a learner interface that is clearly structured and intuitive facilitates navigation and learning and is a critical success factor for uptake and use. Employing different technological features, such as videos, audios, text, infographics, pictures and interactive tools, increases the engagement of learners.

Training measures should meet the need of learners (ideally with their input) while accommodating their different starting points as learners may have various backgrounds, contexts, professions and experiences. Therefore, it is advisable to provide basic introductory information to level knowledge and skills. Learners should be engaged and motivated to apply what they have learned. At the same time, they should be aware of and stay within their limits.

Assessment and evaluation of course material, output, (health) outcomes and cost–effectiveness should take place regularly in order to revise and refine the content and delivery of the learning materials as part of continuous quality improvement efforts. If possible, evaluation from an economic and health outcome perspective should be considered.

Enhancing e-learning with blended-learning, offline material and support mechanisms

E-learning measures could be enhanced with blended-learning elements. Or, in places with insufficient technical equipment or access to the internet, e-learning materials could be used to facilitate teaching and learning in a group.

In addition to online content, consider providing a written manual reflecting the content of the e-learning course. This can be used for revision purposes and/or for settings where access to a personal device or stable internet connection might not always be a given (for example, WHO's *Vaccine safety basics learning manual* [2013]).

Interaction with other learners and facilitation by a moderator or instructor enhance motivation, learning and retention. However, this interaction depends on available resources such as support services, which can increase effort and expense.

Availability of financial and human resources

Expenses for advanced technology, including infrastructure, hardware, software and personnel to prepare and maintain (updating, learner support, etc.) e-learning measures should be assessed for the long term. Consider available resources, possible collaborations and access to external sources of funding. Box 3 features some technology considerations for e-learning programmes to be accessible.

Limitations of e-learning

An mOralHealth training measure is a great way to enhance knowledge and skills. However, it cannot substitute for full-scale training as an oral health or general health professional. Additional competencies and skills are always beneficial, but utmost care must be taken not to overrate the knowledge and skills of those trained. Overestimating competencies may result in health risks to patients and must be avoided.

2.2.3 Training module content development

A needs assessment conducted prior to planning the mOralHealth programme is key to get clarity on the training needs of the different target groups. It will inform what knowledge and skills are most needed and useful. It will also provide insights into how the training is best conducted and which modalities are likely to have the best outcomes.

An mOralHealth training module may include dental public health knowledge or oral health promotion strategies as well as information on preventing and managing oral diseases. Specific interventions adapted to a national context in the most prevalent pathologies and guidance on referrals to other levels of the health care network can also be provided. Interprofessional training components could be developed to give information on oral and general health and upskill non–oral health professionals.

Pilot projects should be undertaken to verify material acceptability and impacts on the outcome to be analysed. The pilot results should inform refinement of the training programme before it is rolled out.

BOX 3:

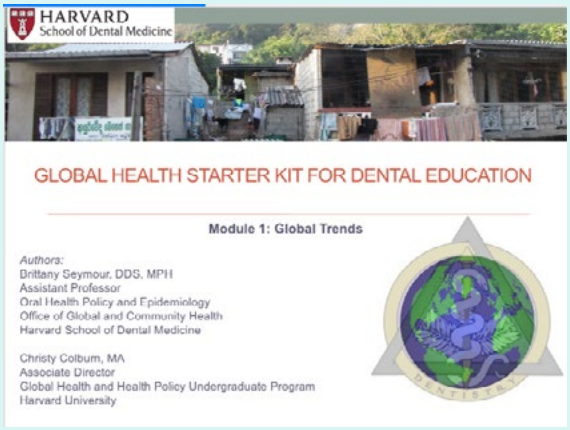
Technical tools

The availability of technology will need to be considered in the design of the mOralHealth training module. There has been rapid advancement in the development and availability of technical tools. The information in this section was correct at the time this handbook was developed, but it is important to note that requirements will change over time.

For the development, internet, cable or wireless access to dedicated equipment should be served by a minimum nominal (logical) band of 640 Kbps so that even with fluctuations, the average is around the minimum 128 Kbps for video transmission. The appropriate equipment will be a desktop or laptop, mobile phone or tablet, minimally with:

- LCD screen
- keyboard and mouse
- 2 GB RAM or higher
- multicore processor with 64-bit instruction set, 3.2 GHz minimum internal clock rate, minimum external frequency, megahertz (front side bus) and minimum internal cache 2 MB
- 160 GB hard disk or higher
- 1.2 MP webcam
- speakers
- headphone
- VoIP application (sound and image over IP)
- applications as needed (text editor, spreadsheet, desktop editor, presentations and database).

CASE STUDY:
Global Health Starter Kit (USA)



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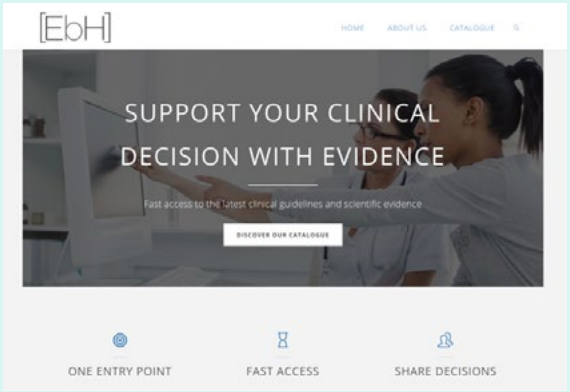
The The Global Health Starter Kit is a competency-based global health starter curriculum designed for dental educators and students. This curriculum is free and available for anyone to use and is organized into two versions. The first version contains materials (guide, notes, presentations, videos and video transcript) for educators and teachers, and the second version contains materials for students and self-guided learning.

This Starter Kit consists of five modules: 1) Global Trends, 2) Global Goals, 3) Back to Basics Primary Care, 4) Social Determinants and Risks and 5) Ethics and Sustainability. It was developed by the Harvard School of Dental Medicine and the Consortium of Universities for Global Health's Global Oral Health Interest Group to improve knowledge of health professions educators on global health. Several specialists have been involved in creating the content: dentists, paediatricians, sociologists, primary care physicians, policy professors and public and global health professors. In 2020, 102 users were registered from 30 countries. The training modules are available at https://hsdm.harvard.edu/global-health-starter-kit or on the YouTube channel of Harvard Dental School (e.g., the Module 1 Learner Video is available at **https://www.youtube.com/watch?v=ySlPsOVIo6A**) *(30–34)*.

Strengths: streamlined, thorough, evidence-based materials, classroom tested, consensus-building process of development, unique programme, open access

Limitations: available only in English

CASE STUDY:
Evidence-Based Healthcare Now (Canada)



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A group of researchers, developers and experts in evidence-based health care at McGill University (Canada), Université de Montréal (Canada), Concordia University (Canada) and Universität Bern (Switzerland) created a digital tool to provide instant access to evidence-based publications on the outcomes of dental treatments.

Evidence-based treatment planning in dentistry helps clinicians provide the most contemporary treatment justified by a thorough review of alternative treatments, diagnostic information, patient wishes and evidence-based outcome data. No matter how conscious the dental community is about the importance of evidence-based dentistry, it is rarely applied, mostly because of time limitations. Therefore, quicker access to evidence-based knowledge may help dental clinicians, mentors, researchers and students effectively implement evidence-based practice. Since 2017, the EBHnow website (**https://www.ebhnow.com**) has been used in more than 90 countries worldwide by over 200,000 users. It is mainly used by dentists, dental hygienists, specialists and dental students *(35, 36)*.

Strengths: fast and easy access to evidence from a specific clinical case

Limitations: available only in English

2.3 Developing an mOralHealth early detection module

Most oral diseases are treatable, particularly if detected and diagnosed at an early stage of disease development. Recognizing signs of oral diseases through early detection and taking prompt action lead to early diagnosis, which may increase the chances of successful management and treatment of the diseases. However, barriers exist that result in limited or no access to oral health services, often leading to delayed treatment. Delays in accessing health care are common, particularly in lower resource settings and vulnerable populations. Such delays may decrease survival and increase morbidity and/or mortality. Early detection aims at increasing the proportion of individuals who are diagnosed and treated at the earliest possible time.

Barriers to accessing oral health services may include low health-care-seeking behaviour, unaffordable services, geographical location leading to greater costs and time needed to reach oral health services, limited mobility due to older age, disability, being bound in a setting (e.g., in a detention centre, clinic, etc.) and logistical challenges to arranging an appointment, among others. With the advancement of mobile technologies for early detection and diagnosis applicable to the field of oral health, the potential exists to address some of these barriers.

2.3.1 Target audience/groups

Two potential target groups should be considered for an mOralHealth early detection module:

- health professionals, carers and the like: frontline health workers who can use the early detection programme (e.g., tele-detection system) and the oral health professionals involved in managing the incoming data
- communities: those that could benefit from the early detection system, particularly those that face barriers like remote locations without access to oral health services (rural areas), older adults, persons with chronic diseases and disabilities or those with restricted mobility (e.g., detainees, military).

2.3.2 Design of the framework

It is important that any mOralHealth early detection module be included in national strategies as services and support need to be available to manage and treat the oral diseases identified. An mOralHealth early detection module incorporating intraoral cameras and telemedicine systems offers opportunities to detect oral diseases remotely. This provides a new paradigm of care that must be considered. Frontline health workers must be familiar and comfortable with the technology and systems, and new relationships between health workers and oral health professionals may have to be established.

Additionally, the following considerations should be taken into account when designing an mOralHealth early detection module.

Regulations regarding medical data management

What are the country regulations regarding the management of medical data that may be produced from the module? For example, are there rules around who can record the data needed (e.g., medical information, dental history, photos, videos) and how the data must be stored and transferred?

Health care professionals and other persons

Which types of professionals can be involved in the module? For example, which types of health workers can record the data and could these be non–health professionals, is specific training needed, and which types of health professionals can be involved in the analysis of the data? Can other non–health professionals be involved, like caregivers for the elderly or teachers for children?

Intervention type

How is this type of module considered? Is it classed as an assessment/consultation, is it medical practice, or is this type of telemedicine considered differently, and how will those involved be paid for their services?

Patient rights

What are the patient rights regarding this module? How is patient consent obtained and privacy maintained, and how are cultural and religious factors considered? Is there a choice in who analyses the data, will the patient be made aware of who is analysing their data, and can recorded patient data be used for further analysis and research purposes?

mOralHealth early detection approaches

In terms of early detection and care delivery, digital clinical decision support systems (CDSSs) have been helping health workers to diagnose health problems since the late 1950s and helping to formulate treatment plans since the late 1960s *(37)*. CDSSs have evolved from simple algorithms based on binary presence or absence of symptoms to, for example, elaborate neural networks that use machine learning to predict the likelihood of oral cancer or precancer *(38)* or to plan treatment of dental caries *(39)*. A CDSS can be stand-alone or can interact with radiology or clinical databases to gather large amounts of data in an AI feedback system, learning to further elaborate its decision-making capabilities. Data from intraoral cameras or scanners can be fed into a CDSS, which can then make detailed observations to flag potential lesions or abnormalities that may be missed with the naked eye.

Patient and health care professional centred

Patient-centric interventions empower the patients themselves to capture data required for screening. This is done through intraoral video or images typically captured with a smartphone and transmitted to a remote expert for diagnosis.

For interventions centred on a health care professional, a health care professional captures the video or image using intraoral imaging technology to carry out spot screening and diagnosis or transmit the data to a remote expert for the diagnosis.

Light-based and RNA-based technologies

Light-based technologies work either through taking photos of the oral cavity for scrutiny, sometimes in combination with biopsy, or by measuring tissue reflectance and tissue autofluorescence. Autofluorescence is the natural ability of biological structures (e.g., tissues) to emit light in the visible spectrum when they absorb photons. This is triggered by exciting the tissue through high-energy light of wavelengths between 300 nm and 400 nm, peaking at about 440 nm *(40)*. The tissues then emit light in the visible spectrum. Normal tissues have higher emission than abnormal ones, and the quantitative differences allow clinicians to tell them apart. The tissue reflectance technique uses a dye (1% acetic acid solution) to stain tissues, which are then viewed using blue-white light. For instance, malignant tissue will appear white under the blue-white light while normal tissue will show a light blue. Studies on the efficacy of the tissue reflectance techniques are, however, inconclusive. On the contrary, studies have found autofluorescence techniques to be more accurate at identifying premalignant tissues *(41, 42)*.

Considerations for the selection of light-based technology include the image/video quality, the ease of use when capturing data (portability), transmission capabilities, ease of powering (power source), the core light-based technology and teleconsultation readiness.

RNA-based technologies are noninvasive and work by testing for RNA biomarkers in patient saliva. The studies on the efficacy of this technique are still inconclusive for specificity and sensitivity.

2.3.3 Collection, storage and processing of data

Considerations must be made as to how the data will be collected/recorded and then how these data are sent/transmitted, stored and analysed.

Recording the data

For programmes that use devices like cameras, it is important to remember that the device must be evidenced based and clinically validated for the purpose that it will be used for before as well as after specified periods of use. The nature of the data (e.g., videos or photos) collected will dictate which type of device is needed; mobile-phone cameras may be suitable for general detection but may be inadequate for diagnosing specific diseases. Fluorescence or transillumination could be useful to improve accuracy.

Sending/transmitting the data

Connectivity and the quality of the telecommunication network need to be considered as well as the type of device used to capture the data. Adequate gigahertz (GHz) are needed to send photos and videos from the device to a server. A secure virtual private network (VPN) could be used, or if regulations permit, the data could be sent by SMS, messaging applications, social media or email.

Storing the data

Data are saved and stored on a central server. Regulations on the storage of personal and medical data will provide detailed requirements. It is important to consider storage capacity, security and backup capacity.

Analysing the data

Appropriate technology will be required for the data to be viewed and analysed (e.g., screen/monitor), and a connection to the server will be needed. Also consider how the analysis and any reports will be stored, transmitted back to the patient and frontline health worker, sent to appropriate health services and/or integrated into the patient's health care record.

Technologies should be based on solid evidence and need to be validated in the context where they are intended to be used.

AI and machine learning (ML) have been used successfully in many areas, and advances in computer vision, image processing and pattern recognition show great potential. Using AI and ML, a computer can initially and quickly analyse images and videos, with the option of having a second opinion from an expert. These technologies have the potential to speed up diagnosis and help to tackle the problem where the dentist–patient ratio is low, although challenges around implementation into practice will need to be overcome.

Existing systems

Existing telemedicine systems (within the country and internationally) should be reviewed and considered before additional software is developed. Where national health care information systems exist, the mOralHealth early detection module could be linked to the national system to access existing patient data and integrate the new data collected. Any new information system should be developed considering its interoperability with existing national systems.

2.3.4 Adaptation to the country context

A number of technical innovations exist that can be used in the context of an mOralHealth early detection module. Based on current knowledge and experience, digital technologies have the potential to support remote access and consultation for early detection followed by referral to services for definitive diagnosis and management. Studies show that combining a conventional oral examination with digital technology assistance improves the accuracy and quality of early diagnosis of some oral diseases *(24, 25)*. In particular, technologies that improve visibility in the oral cavity for premalignant mucosal lesions have proven promising. This is an area of continuous development with the need for further innovation, testing and evaluation.

Applying remote detection and diagnostic technologies is not universally feasible and highly depends on the country context. Accordingly, the development of an mOralHealth early detection module needs to be informed by the findings of the needs assessment (see **Section 1.2**). Technologies should be based on solid evidence and need to be validated in the context where they are intended to be used. Any intervention inherently needs modification to achieve effectiveness in the region in which it is be implemented, also considering social, cultural and economic aspects.

2.3.5 Pretesting, piloting and refining the early detection module

Pretesting and piloting ensures feasibility, acceptability, appropriateness and usability within the target groups, considering the culture of the target population, the professionals involved and the national health system. Satisfaction from target groups should also be measured. The pretesting should be carried out with the target population, including those who will be involved in recording the data and those involved in analysing and interpreting the data. The clinical validity of the module must also be assessed at this stage, prioritizing patient safety. Technical issues can be identified at this stage, and refinement of the system should be carried out based on the results of the pretesting and pilot. Continuous monitoring during module implementation should be an essential component to inform ongoing refinement as needed.

CASE STUDY:
e-DENT (France)

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Access to oral health care is not a given for some population groups. Access to oral health professionals may be restricted, particularly for older adults with limited mobility, persons with disabilities and chronic illness and persons in detention centres. With that in mind, the Regional Health Agency of Languedoc-Roussillon and the University of Montpellier launched the teledentistry system to support asynchronous remote oral consultation and diagnosis in 2012.

Requirements stipulated by the national law on telemedicine that permits medical professionals to use ICT for remote diagnostics set the legal framework for the project. A telemedicine contract had to be drafted to frame practice, organization of activities and roles of different parties for the telemedicine activity.

An initial clinical study was conducted to assess and validate the use of an intraoral camera with fluorescent light for remote diagnosis. With the camera, (precursory) lesions, gingival inflammations and dental plaque are made visible. Additionally, a telemedicine platform specialized for dentistry was set up. The platform required managing the recording of patient data and videos while ensuring secure transfer and storage of data to protect patients' privacy according to the legal requirements. A workflow was developed to formalize a protocol and clear sequence of steps.

Prior to carrying out remote diagnosis, a health care professional or carer in the respective setting, typically a qualified nurse, received training in the main principles of dentistry, application of software, handling of the intraoral camera and steps of recording the required information. During the process of applying remote diagnosis, the qualified nurse is present with the patient to facilitate recording of necessary information. Once the data are recorded, an oral health professional at a distant location can perform the dental diagnosis and propose a treatment plan and an adapted medical pathway for the patient, integrating the medical status, cognitive state and oral health status. A report is created and sent back to the nurse through the system to inform the patient and the medical team.

There is usually no vital medical urgency, so these processes can be performed asynchronously. The advantage of this is that the person doing the recording and the dental surgeon do not need to be connected at the same time, which allows for greater flexibility in coordination, organization and implementation. Collecting information and recording video as well as the analysis, diagnosis and development of a treatment plan can take place at a convenient time for both sides without time pressure and can accommodate the intervention according to their schedules. The recording does not require a secure, stable Wi-Fi connection. Therefore, the intervention can take place in a convenient location (e.g., patients' bedrooms). The data can be transmitted later when a secure internet connection is available, reducing costs and logistical efforts.

Within three years, more than 2,000 remote diagnoses through telemedicine had been conducted, resulting in improved quality of oral care for respective communities. Older adults and patients with disabilities appreciated that the oral examination did not require travel and that familiar persons performed the intervention. Detainees benefited from more frequent dental checkups and related prioritization for treatment and reduced number of emergencies.

The e-DENT project was financed as a pilot trial. To establish a continuous practice of remote dental diagnosis, a sustainable economic model is key. Remuneration and redistribution of revenue among all involved parties and development and setup of specialized software and a data host need to be considered, among other things *(21, 43–45)*.

Strengths: improved frequency of dental checkups for frail people, early identification of oral and dental pathologies, improved coordination of the dental pathway.

Limitations: need for a trained health professional close by the patient, initial infrastructure set-up cost high unless this can leverage existing telehealth platforms in use.

Further information can be found in the list of additional mOralHealth projects in **Annex 1**.

CASE STUDY:
EstomatoNet (Brazil)

The Telehealth Brazil Programme was implemented by the MoH in Brazil in 2007 with the aim of qualifying PHC. Since then, there has been a notable expansion of telehealth actions in Brazil with federal universities, and here we highlight the Telehealth Centre that was created in collaboration with the Federal University of Rio Grande do Sul (TelessaúdeRS-UFRGS).

The telehealth project in Rio Grande do Sul, Brazil, comprises a number of components, including synchronous and asynchronous teleconsultations, telediagnosis services (EstomatoNet), webinars, distance learning, tele-education and formative second opinions. The service is intended to provide support for clinical practice, give diagnosis and management advice to practitioners and prevent unnecessary referrals to higher levels of care, thereby reducing costs and supporting the management of low-complexity cases at the primary care level.

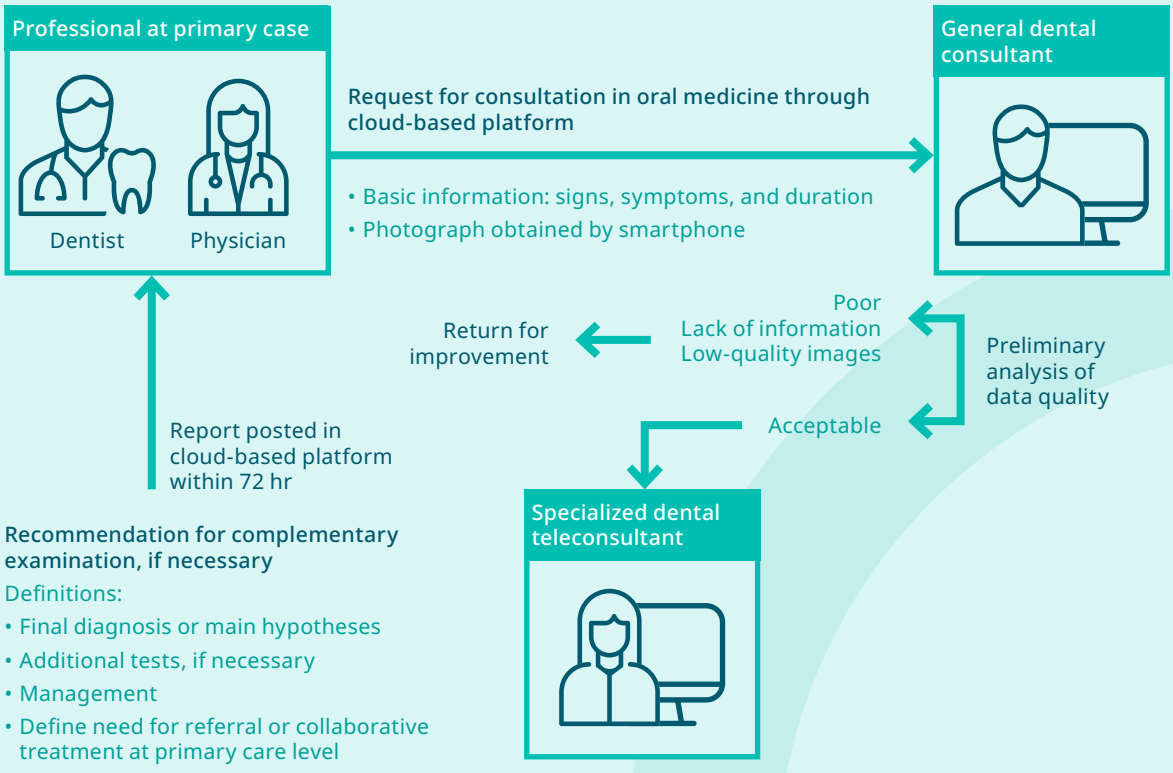
Teleconsultations are carried out synchronously through free-of-charge telephone calls, where PHC professionals from all over Brazil can get in touch with professional teleconsulting, including dentists. Clinical cases in dentistry and general issues related to work processes can be discussed. The applicant can send clinical photos or complementary exams to assist the teleconsultant in diagnosis and suggest clinical conduct.

Consulting with EstomatoNet facilitated a significant decrease in PHC practitioners feeling unable to diagnose or treat patients and intending to refer them for specialized treatment. High rates of satisfaction with responses were reported, as well as significant changes in treatment approach by the PHC practitioner following teleconsultation and a decrease of 45% in referrals to other levels of care *(46–53).*

Strengths: Access to support from specialists; reduction in waiting times for consultations; increases equity by removing geographical barriers to care; refines the information in the referral system and allows the definition of priority criteria.

Limitations: Requires stable, good quality internet connections; lack of data and clinical photographs.

More information is available in the list of additional mOralHealth programmes in **Annex 1**.



2.4 Developing an mOralHealth surveillance module

Public health surveillance activities include the regular collection of health-related information in the population. Selected health indicators are routinely monitored and results analysed over time across population groups and geographical areas. Regular dissemination of results and the related scientific knowledge provide information for planning, implementing and evaluating public health interventions as well as inform decision-making and health policy development.

Oral health surveillance over time and monitoring and evaluation of activities are key elements of a public health programme. Decision-makers need qualitative, up-to-date oral health information from reliable surveillance systems for policy-making, planning, tracking progress and measuring impact of interventions. WHO encourages countries to conduct population-based integrated oral health surveillance and monitoring based on existing survey tools. These tools include the STEPwise approach to surveillance and the Global School-Based Student Health Survey, to name a few. Using digital technologies for disease surveillance via the internet and mobile phone apps can potentially support and complement traditional disease surveillance systems.

Beyond population-based surveillance, many systems have been developed and established for early detection, immediate response and surveillance. This information is essential for forming effective interventions, improving awareness, preventing disease, and providing care and comprehensive management. These systems are continuously evaluated and improved; however, traditional surveillance systems that rely on medical/dental or other health providers may be inefficient or incomplete and may experience delays between the event and reporting, which may result in an incomplete account of health events *(54)*.

Digital and mobile technologies can improve the ability to collect, analyse, manage and exchange information and data in all areas of health. They are used to improve health information systems at every level of the health system, from community to national and international levels. Using digital and mobile technologies can also improve timeliness and accuracy of data gathering and transmission *(14)*.

Mobile devices and social media have considerable potential in the context of surveillance programmes. These technologies represent an enhancement of traditional systems rather than an alternative system of oral health surveillance. As such, they should provide opportunities to improve what is already being done, for example by improving interaction with other surveillance systems.

The development or adaptation of an mOralHealth surveillance module should be informed by the existing evidence on surveillance programmes (specifically oral health programmes), aligned with WHO and national guidelines and based on the findings of an mHealth country needs assessment (see **Section 1.2**).

2.4.1 mOralHealth surveillance target audience

Widespread access to mobile phone–based data collection tools (e.g., text, photo, video, audio) opens up new opportunities for epidemiologic surveillance. An mOralHealth surveillance module may include a range of target groups for data collection in the context of oral health surveillance. These groups can include:

- the entire population
- people with oral health conditions
- health care professionals
- oral health professionals
- researchers
- administrators.

Although including target groups that are not typically involved in any surveillance activities has the potential to expand data pools, it is important to be cautious and consider data/information accuracy, potential bias from self-reporting and other forms of bias, such as selection bias, which may under- or overrepresent certain population groups.

2.4.2 Design of an mOralHealth surveillance framework

Gathering, processing, and analysing data can be a complex undertaking. Mobile technology can provide a feasible approach for small- as well as large-scale surveillance. It holds the potential to be a cost-effective and time-saving strategy with regard to data entry and management, resulting in quality, real-time data for analysis and decision-making. Evidence also indicates that mobile data collection and management can be more reliable, economical, user-friendly and faster than traditional paper-based methods. However, it requires a systematic approach as well as technical knowledge and resources to set up a team and develop software and related systems. The following considerations should be taken into account when setting up the framework for an mOralHealth surveillance programme *(55, 56)*.

Purpose of the surveillance

The purpose of the surveillance determines who will be monitored, who should collect the data, on which scale surveillance should take place and which design will be most suitable. Developing and selecting relevant indicators are crucial and need to meet the purpose of surveillance and the research questions at hand to inform health sector response and decision-making in public health and policy development.

Scale of surveillance

Mobile data collection can be performed on different levels. A national surveillance of oral health and oral diseases requires a more complex setup, with a team of developers, data managers, support staff, principal and co-investigators, a mobile data collection system, data protocols, and related structures and resources. Smaller scale surveillance, such as community- and district-based surveillance, or opportunistic monitoring involving laypersons may be less complex and still provide informative data.

Data collection method and appropriate technology

Mobile technologies have opened new ways of collecting, sharing and processing information but require selecting adequate technologies and developing software, a technical protocol and an implementation plan. The overall technical specifications of an mOralHealth surveillance module will depend on the nature of the module and the context. An appropriate mobile device for data collection and transmission needs to be identified, such as a basic mobile phone, smartphone, notebook or tablet. Even basic mobile phones can be employed using SMS to collect and forward data. Data can be checked in real time for quality assurance, to reduce losses and errors and for timely analysis. Mobile technology needs to be accepted and usable by those identified to collect the data. Furthermore, an appropriate system needs to be set up based on a technical protocol, which depends on the needs of the surveillance purpose and guides the development of mobile apps, data transfer, web-based platforms, servers, content databases, appropriate data safety and security measures, and access rights, among other aspects. The system application should have a simple, clear, easy-to-use interface that users with limited technical and/or oral health knowledge can use with little need for technical support.

Lack of or limited mobile network coverage can be a problem. There are ways to circumvent these connectivity problems, with store-and-forward capability of the software app, for example. Data can be stored until access to a network is available to upload data. Paper-based surveys can be used as a backup system in case of technical challenges.

Data collection methods and management and the overall system need to be tested and their validity and usability assessed.

Data collection and management

For a national systematic surveillance activity, it is advisable to set up a study team, possibly including data collectors, supervisors and research support staff as well as principal and co-investigators. For smaller scale studies and monitoring activities through laypersons such as patients, a smaller team for technical setup, supervision and analysis may be sufficient.

Instructions and training

Depending on the complexity, instruction or training is useful for the process of data collection and management. If laypersons gather data through an app, it might be sufficient to give some brief instruction on how to use the app and guidance on how to answer survey questions (e.g., through text messages, audio, images or videos). In the case of a national surveillance activity with a study team or regular collection by health professionals, more comprehensive training is advisable. This training could include information and practices on how to use the mobile device, access and handle the software app, administer survey questions, store and transfer data, deal with technical challenges and so forth. In the case of a long-term data collection activity, a refresher course may be required. Supervision and access to remote supervision via phone can also be helpful to address issues that may come up. Providing feedback and sending confirmation messages upon receipt of data can motivate those collecting the data.

Cleaning, analysis and dissemination of data

Collected data need to be scrutinized for accuracy, and any gaps or errors need to be followed up and resolved. Ideally, interoperability of the data collection system is ensured, and collected data are integrated into an existing surveillance system, complementing other data sources. Making it possible to export collected data to a statistical software program can facilitate analysis and evaluation. This links back to the overall purpose of the surveillance.

2.4.3 Pretesting, piloting and refining the early surveillance module

It is important to ensure that all the components of the mOralHealth surveillance system work together effectively and to comply with necessary requirements and specifications. Pretesting and piloting of the programme should ensure validity, usability and acceptability from the user perspective as well the efficiency and effectiveness of the technology for the purpose. This allows for modifications to be made to the module before implementation. In summary, this stage should ensure that 1) all components function correctly and follow the requirements and specifications, 2) the module results in outcomes that it is to address, 3) the diagnostic system for non–oral health professional users is validated, and 4) the module is feasible, usable and acceptable.

CASE STUDY:
Dental Trauma Tracker (Australia, Chile)

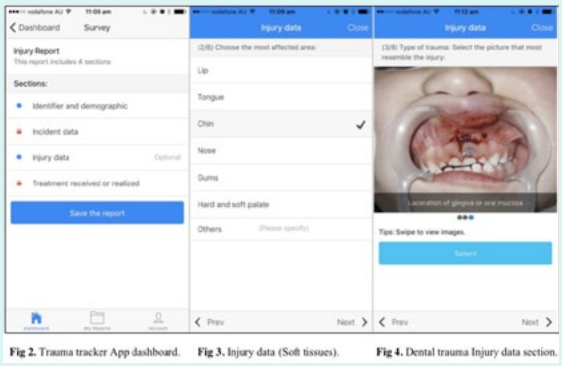


Fig 2. Trauma tracker App dashboard. **Fig 3.** Injury data (Soft tissues). **Fig 4.** Dental trauma Injury data section.

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Injuries are common and are considered a public health problem. This includes traumatic dental injuries, which refer to injuries ranging from minor tooth fractures to more significant displacement of the teeth with or without damage to the surrounding bone and soft tissues.

In 2017, a mobile phone–based app, the Dental Trauma Tracker (DTT), was developed for community-based surveillance of traumatic dental injuries. The DTT system involves a mobile application for general users to report dental traumas and a web application for researchers to generate epidemiological data. DTT's validity and usability were assessed. The DTT evaluation used mixed methods and was conducted in three phases: 1) validation of a trauma identification system using preselected images; 2) design evaluation by experts; and 3) usability evaluation measured by reporting three fictitious cases and using the system usability scale.

Lack of representative data and information on the circumstances of traumatic dental injuries poses a challenge for oral health care services to adequately address dental trauma through appropriate treatment, health promotion and prevention strategies. The widespread use of mobile technology facilitates development of innovative participatory surveillance strategies. Against this background, an oro-dental trauma surveillance system was set up to gather data to strengthen assessment and response at a local level (e.g., appropriate first aid, identifying high-risk locations and activities, etc.). The DTT project comprised a mobile phone–based application and a web app. The mobile phone app was developed for a number of users, such as patients, teachers and potentially also health care providers among others, to answer a questionnaire with standard information associated with dental and maxillofacial trauma for the epidemiologic surveillance based on the Centers for Disease Control and Prevention's Minimum Essential Data Set for oro-dental trauma.

The DTT app was used to collect on-site data, including personal and demographic data, accident data and injury data (dentition and teeth affected, type of dental trauma, etc.) in different formats (e.g., text, photo). A library with representative injury pictures facilitated identification. The app enabled storage in a database, followed by interventions and follow-ups to facilitate evaluations of efficacy. The app was available on multiple platforms, including iOS and Android. A secure password-protected user login and registration system ensured privacy and security of users.

The web app facilitated collection (e.g., adaptation of questions for different user groups) and management of the data for researchers and administrators. It also allowed analysis of dental trauma reports and epidemiological indicators (e.g., distribution of dental trauma by sex, age group and location). Based on the collected data, a risk map could be generated. An HTTPS protocol to secure the communication network and an encryption algorithm to protect sensitive data were used.

Preliminary usability testing based on a sample of potential users and fictitious case studies demonstrated that the DTT was effective, efficient and accurate and that it was accepted by its users as a community-based disease surveillance tool *(57, 58)*.

Strengths: Easy to use; supports multiple platforms such as IOS and Android; secure password-protected user login and registration system to ensure privacy and security.

Limitations: Working prototype system collecting only dental trauma; needs to be scaled up to prove its feasibility; available only in English.

CASE STUDY:
Dent@Prevent (Germany)

The Dent@Prevent project has developed a prototypic CDSS to enhance the interdisciplinary integration of diabetes and periodontal care among general practitioners and dentists. The prototypic CDSS was designed to operate primarily on the basis of patient-reported data. Through a mobile app, patients fill in a survey based on the Periodontitis Risk Score, the Finnish Diabetes Risk Score (FINDRISC) questionnaire and a basic anamnesis.

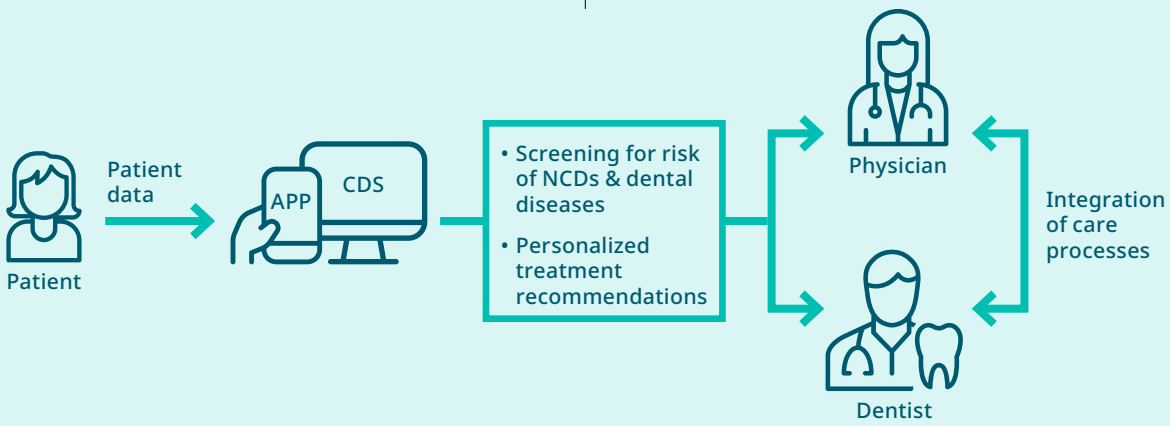
The CDSS accordingly calculates the patient's risk for periodontitis and type 2 diabetes mellitus. For patients with a calculated high risk, CDSS provides information to the end user about the bidirectional relationship between type 2 diabetes and periodontitis as well as their common risk factors. In addition, upon increased diabetic/periodontitis risk, the CDSS recommends a visit to the general practitioner or general dental practitioner to check for potential diabetes or periodontitis, respectively. General dental practitioners are also encouraged to ask for glycated hemoglobin (HbA1c) values of known diabetics and take these into account when planning periodontal treatment. The Dent@Prevent CDSS warrants broad future interoperability with other data/information sources such as sensors, scanners and biomarkers via application programming interfaces (APIs).

During the prototypic test, the CDSS has been used by 202 general dental practitioners and 206 general practitioners. This kind of tool could be implemented by governments, public health authorities, health insurance organizations, hospitals, medical and dental practices, and providers of e-health platforms and mobile apps for citizens/patients.

Strengths: one-stop-shop solution for getting the right information to the right person in the right format through the right channel at the right time; potential to serve as a blueprint model for integrated interprofessional care for the entire spectrum of NCDs

Limitations: fragmentation of dental and medical practice software systems/standards/terminology complicates full integration of all providers

For further information, see https://www.oralsystemicintegration.com/about-the-project/.



3

Promotion, participation and retention

This chapter provides strategies to create a tailored mOralHealth programme that will engage participants, including:

- promoting the programme
- increasing participation
- retaining participants

3 Promotion, participation and retention

3.1 Promotion of the mOralHealth programme

Advocacy and promotion of the mOralHealth programme are crucial to inform and attract members of the target groups to participate in the mOralHealth module. Without a critical number of participants, the mOralHealth programme will only have limited outcomes. Making the subscription process as easy and convenient as possible will reduce deterrence and facilitate enrolment.

Promotion campaigns and recruitment into the programme through a nationwide or target user–specific strategy are essential activities. Employ multiple engagement platforms to address respective target groups more generally as well as in specific ways through channels aimed at particular users. The most appropriate channels depend on the country context and where contact with target groups is most likely.

To best utilize outreach activities and minimize efforts and costs, carefully develop a strategy for promotion, recruitment and dissemination during the early stages of the planning process. **Table 7** presents important considerations, learning points and suggestions from other BHBM programmes.

3.1.1 Target audience and access to media/ promotional and recruitment strategies

There are two broad target audiences in the context of promoting and recruiting for the mOralHealth modules: members of target groups and promoters.

Once defined, learning more about the target audiences – if not already done through focus groups, interviews and surveys – is useful for designing the promotion and recruitment strategy. Professional agencies can help with this if sufficient resources are available.

The more that promotion and recruitment strategies are tailored to the target groups, the more effective they will be at encouraging members of these groups to subscribe and the wider the reach of the mOralHealth programme. Understanding the groups' characteristics and motivations can help make recruitment more successful (e.g., leveraging motivation for change in the recruitment campaign).

One BHBM programme suggested segmenting the target groups by different characteristics and tailoring promotion materials accordingly. It was suggested to run some focus groups with representatives of the respective target groups during the preparatory stage of developing the mOralHealth programme to inform the design of the programme. These focus groups can also be used to gather ideas and recommendations of recruitment methods as a basis for the promotion strategy.

TABLE 7.

Considerations for promotion, recruitment and dissemination

mOralHealth literacy module

Target audience/group members

patients, parents/caregivers, teachers, general health professionals, etc.

Promoters

oral health professionals (dentists, dental hygienists, etc.), general health professionals (doctors, nurses, frontline health workers, CHWs) social workers, pharmacists, phone vendors, contract vendors, health promotion NGOs and related actors

mOralHealth training module

Target audience/group members

oral health professionals, general health professionals, teachers, carers

Promoters

dental schools, continuing education institutions, medical schools, training institutions, national health care system administration, employers, etc.

mOralHealth early detection module

Target audience/group members

high-risk groups (e.g., people exposed to risk factors such as strong consumption of tobacco and harmful use of alcohol), people with limited access to oral health services (e.g., living in remote areas, limited mobility, etc.), general health professionals (e.g., frontline health workers)

Promoters

oral health professionals, general health professionals (e.g., frontline health workers), insurance providers

mOralHealth surveillance module

Target audience/group members

general population, oral health professionals, general health professionals, parents, teachers

Promoters

health care providers, oral health professionals, general health professionals, CSOs

3.1.2 The owner or perceived messenger of the mOralHealth programme

Ensure, if possible, that the members of the target groups are aware that the programme comes from or is recommended by the MoH or another trusted health authority. Consider setting up a page on this authority's website where potential users can access information about the programme and adding the link to promotion materials.

Identify other trusted actors, institutions or authorities (e.g., local partners and stakeholders that can help with promotion and recruitment). Partners can include religious or social organizations, cultural activity groups, CSOs, public and private health institutions, oral and general health practitioners, educational institutions and the like.

3.1.3 Cost of the promotion campaign

Cost of social media advertising (and radio and TV, if target users suggest) can be high in some countries but may be an important method for promoting the programme if research with target users suggests this strategy. Consider collaboration with social media influencers in the spirit of benevolence and social impact.

Initially underestimating promotional costs is common and can be difficult to remedy later. The principles of negotiating with telecoms companies can also be useful when negotiating with broadcasting and social media companies (see Annex 6).

3.1.4 Synergies with existing strategies, leveraging other campaigns and timing

Campaigns for health, and can those campaigns be linked or leveraged? Which mHealth programmes have previously been implemented in the area? Can lessons be learned about which promotional techniques are effective in the country?

Leveraging the existing marketing and health promotional campaigns of programme stakeholders or partner agencies such as telecoms companies may save effort and expense. If the country is already running a campaign on improving oral health or tackling NCDs, the mOralHealth programme can be integrated as an add-on. For example, if you have mass participation events, such as a marathon to raise awareness of people suffering from NCDs on World Health Day (7 April) or promotion of toothbrushing on World Oral Health Day (20 March), announce the mOralHealth programme and how to subscribe on the day of the mass event.

3.1.5 Accessibility of promotion materials

Consider the target groups and if/how they access certain media channels. What is the media channel they will most likely see and engage with? How can you make accessing recruitment materials more equitable to minority populations or people with disabilities? Promotion should be targeted at groups that are typically difficult to access.

3.1.6 Content of the campaign

Make sure that the promotion materials include all relevant information in a clear and concise way. The potential user should know who the programme is for, what it is about and what they can get out of it in terms of oral health benefits, the conditions of signing up (e.g., any related expenses), and how to access and sign up for the programme. Consider cultural and social attitudes that might influence the target audience's perception of the campaign. Design and communicate messages in a way that is tailored to characteristics of the end users.

3.1.7 Using marketing specialists or learnings from the private sector

It may be that the MoH or other implementing agency does not have the in-house expertise to plan and deliver an effective promotion campaign. Contracting out to a marketing agency may sound expensive, but if the appropriate agency is chosen (one with a good track record in health marketing), it may boost programme numbers substantially.

Creating a call for proposals with the aim of the promotion campaign and disseminating it to companies will solicit proposals with a range of methodologies. Choosing which company to contract will depend on any market research you have done with target groups (e.g., if the proposed methods are appropriate), the company's success and experience with other health campaigns, and a competitive price.

Other BHBM programmes have involved large private-sector companies to get tips on marketing, which helped them to design their campaigns. This support was negotiated to have no cost to the programme.

3.1.8 Testing the promotion and recruitment strategy through a soft launch

Consider a test run or a "soft launch" prior to starting the promotional campaign to ensure that all processes are working well before a large number of participants sign up. This may include running focus groups with representatives from target groups to compare some differently worded or presented promotion-campaign materials or to ask them what messages about the mOralHealth programme and marketing materials would make them want to participate.

3.1.9 Preintervention information session

Launching information sessions about the mOralHealth programme at places the target audience frequently visits can enhance the visibility of programme and encourage participation. These information sessions can be part of the promotion and campaign strategy. Displaying flyers where the target groups visit frequently, such as clinics, community centres, schools, public institutions and public transport, can also increase the accessibility of materials.

3.1.10 Local mobile communications environment and institutional channels

Check whether sending unsolicited messages is allowed (this contravenes telecoms codes of conduct in some countries). Consider whether a population that often receives unsolicited health-related messages will be likely to read and respond to messages from the programme. Also consider the issue of message receipt versus message engagement.

Depending on the mOralHealth module, check whether messages can be sent to specific target groups through existing communication channels, such as health personnel of the national health system.

3.2 Participation in the mOralHealth programme

As the result of an effective promotion campaign, a number of interested users of the respective target groups will be ready to interact with the mOralHealth programme and participate. This enrolment process must be user tested, clear, easy and brief.

Some major barriers affect the uptake and use of mHealth solutions. Costs associated with the intervention can hinder participation. An mOralHealth programme should be free for the user wherever possible, including replies to messages (see **Annex 6** on negotiating with telecoms operators) and downloads associated with use of the programme where mobile devices such as smartphones are involved.

Another hurdle is the enrolment process. BHBM programme evaluations have shown that long or complicated sign-up processes can result in nonparticipation. The more burdensome or tedious the enrolment, the more likely that users will be lost before they have even started. Testing can again be a good way to get feedback from target users and revise the process to make it user-friendly. A balance will need to be struck between getting all the needed data from the users (in order to place them in a segment that receives tailored content or to act as a baseline for key evaluation indicators) and not tiring or boring them so they lose interest. Careful design of this process is necessary, and user testing will be essential in getting this right. BHBM suggests knowing the target users and testing and refining the sign-up process with them wherever possible.

Another option is automatic enrolment for particular groups of health service or telecoms service users. This approach has been used in some BHBM programmes. In Zambia, all customers of one telecoms carrier received messages. In India and Sudan, users were automatically enrolled through health services or door-to-door when they screened positive for being at risk of diabetes (as part of a national inclusive screening programme), and there was a free and easy opt-out mechanism. This option could be a possibility, although contextual factors need to be considered, such as legality of sending unsolicited messages or acceptability of such an approach.

Although target users may enrol in the programme, they may not engage or participate in the module. To learn more about the engagement of target users, two-way messages (providing that responses are free) or gathering data in an app can help to gauge ongoing participation. These messages or requests can be part of the basic content package, such as motivational messages, or designed for the purpose of checking participation and monitoring health behaviour change (e.g., "How did it go with your walking goal today? Reply 1 for met, 2 for ..."), and some of the BHBM message libraries include such messages. Information on participation of target users can also be captured at the evaluation stage. For instance, BHBM has collected useful data in surveys whereby users were asked to estimate the proportion of messages that they a) saw and b) read and whether they sustained behaviour change throughout the programme.

Testing the programme's content with target users is absolutely crucial to make it appealing to them.

3.3 Retention in the mOralHealth programme

Promoting continued participation depends on the respective mOralHealth module as well as context in terms of social, cultural and technological factors. This section suggests some ways, based on BHBM programming experience, to foster retention and reduce dropout.

The programme should be promoted accurately to ensure that users have correct expectations at enrolment. Promotion should describe the purpose of the programme as well as its features and duration. The programme should include concrete goals and progress checking towards those goals, as this is a strong motivator for behaviour change. However, benefits of the programme should not be exaggerated or misleading. If there are any costs (e.g., in the case of two-way messaging), these should be communicated clearly. Giving users a clear understanding of the programme will ensure that their expectations are met and therefore keep retention high.

Dropout is common in health behaviour change programmes, and mHealth programmes are no exception. It is important to enhance the programme in a way to motivate target groups to actively continue. For text-based interventions, such as the mOralHealth literacy module, two-way messaging or interactivity where the user receives dynamic and focused support or messages/tasks about goal setting and follow-up is one way to improve effectiveness and retention (e.g., in a messaging programme, "Send the word SUGAR to learn more about the impact of food and drinks high in sugar on your teeth"). Interactivity is easier to do with some technologies (such as conversational agents) than others. Tailoring and personalizing messages to the user have also shown positive effects on participation. Interventions with an individualized or decreasing frequency of messages throughout the intervention were more successful compared to those with a fixed message frequency *(59)*. Delivery of messages at appropriate times (e.g., delivering messages at the time the behaviour is likely to occur) or when users can respond to questions (e.g., after work hours) can also reduce dropout.

The module needs to run smoothly and responsively on the technology platform of choice. Technical problems, especially if there is no technical support for users, can be very frustrating and is a major reason for dropout in BHBM programmes. Pretest the platform to ensure that messages or content will be delivered in an accessible and timely way. For example, if the programme features two-way messaging, the response to the user's reply should be instantaneous, and users must be aware if this will be free or have a cost. Otherwise, users will become frustrated and may leave the module. Similarly, an app or digital platform should be free of bugs and be responsive.

Stop messages are often included in SMS or other text-based modules to enable the user to stop receiving messages (e.g., "Reply STOP if you wish to stop receiving messages"). It is an ethical imperative that users can unsubscribe or stop receiving messages if they wish, and it is important in any BHBM programme that they know how to do this. However, literature suggests that programmes with more frequent STOP messages have higher dropout rates *(60)*; therefore, it is important to consider how many times it is necessary to send stop messages.

Users need to be comfortable with engaging in the module and feel capable of handling the technology, so it should be user-friendly and easy to navigate. This is particularly relevant for the mOralHealth training, early detection, and surveillance modules. In this context and depending on the complexity, conducting brief trainings or providing supervision may be considered to foster technology adoption and acceptance.

Incentives are also important for retention in mHealth interventions on training and surveillance. Recognizing the efforts of completing a training with a certificate or receiving a confirmation message after submitting data can incentivize retention and utilization.

In general, the more target users feel that the module is relevant to them and brings additional value, the more likely it is that they will use it and continue participation. Therefore, testing the programme's content with target users is absolutely crucial to make it appealing to them. BHBM programme implementers have also suggested tailoring programmes to different user groups for this reason. Tailoring will mean that screening questions will be necessary to place users in a given group. Replies to these questions should be free, but if for any reason (other than cost) a user cannot reply, they should still be enrolled in a generic version of the module.

If users should leave and two-way messaging is free or users can be contacted, it is useful to ask why they are leaving. (Consent should be gathered for contacting participants about dropout.) Telephone surveys are another way to gather this information. BHBM programmes have surveyed dropouts with interesting findings. Reasons for dropout included that the intervention did not meet the user's expectations based on what was originally promoted, the guidance was too difficult to follow, and more tailoring would have been beneficial. Other feedback included that the messages were not motivating enough and use of images and videos would have been more effective. Combining the messaging programme with other support services would also have been beneficial.

CASE STUDY:
mOralHealth training module – oral health care training for PHC workers

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This training was produced by WHO and the Centre for Dental Education and Research, All India Institute of Medical Sciences, New Delhi. MOOC training modules have been curated with a focus on transferring knowledge and training health care workers, nurses, dental auxiliaries and dentists to reinforce learning on patient-centred approaches to oral health care in primary care settings. There is a focus on screening and referral for oral premalignant disorders (OPMDs) and oral cancer.

The course provides four modules on oral health promotion, five modules on OPMDs and oral cancer, and one module on setting up oral health services in primary care settings.

Dental and oral disease modules:

Introduction to healthy teeth and mouth

Common oral diseases

Life-course approaches to preventing common oral conditions

How to handle dental conditions that warrant urgent attention

OPMD and cancer modules:

Risk factors for oral cancer

Variations in oral mucosa, OPMDs and oral cancer

Early detection of oral cancer

Oral visual examination and mouth self-examination

Diagnosis and treatment of oral cancer

Module on setting up oral health services:

Setting up oral health services at the primary care level

The entire course is user-friendly, created with supporting visuals, animations and lucid text integrated with easy-to-comprehend narration. Each module lasts between 12 and 35 minutes and has been developed with the course competency framework and end objectives in mind. At the end of each module, the learner takes a test, and upon completion of all the modules, a final assessment is required for certification.

Programme managers, programme directors and trainers as well as health care workers and other health professionals (more than 100 in total) from Bangladesh, Bhutan, Nepal and Sri Lanka underwent online training and assessment on the mOralHealth training module. It was delivered as a component of the WHO package of essential NCD interventions for primary health care in 2020.

The WHO South-East Asia Regional Office has signed an agreement with the Indian Dental Association (IDA) to improve oral health services by using the MOOC to train PHC workers in two districts of Maharashtra. The IDA will further expand the training to other regions of India. Its implementation in other countries is also under exploration.

The course is accessible to all and can be found at **http://moocoralhealth.aiims.edu/.**

Strengths: Open and online for all to access, appropriate for multiple cadres of health workers; WHO developed so quality assured; and a WHO certificate of completion is attractive to prospective users

Limitations: Requires stable, good quality internet connections; available only in English.

CASE STUDY:
mDiabetes promotion in Egypt

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In February 2016, the MoH in Egypt launched a national mDiabetes programme at a media event with the aim of increasing people's access to information on diabetes prevention and management.

With support from WHO, the SMS and WhatsApp messaging programme was promoted at health care facilities in Cairo and at public places such as train and metro stations. A Facebook page called "Your Health in a Message" was set up for targeted recruitment. Banners, posters and brochures were distributed to patients along with their prescriptions as well as in outpatient waiting areas, pharmacies and various government offices. The ministry also partnered with popular radio and television channels and journalists to promote the programme and in partnership with WHO conducted a media workshop to inform journalists about the programme, which resulted in widespread media coverage.

A group of social change agents was trained to promote the mDiabetes programme during their home visits in the catchment areas of PHC centres in Giza and Qalyobia, giving diabetes patients the option to register by providing their mobile numbers. A database of diabetes patients was also obtained from public hospital and PHC centre records, diabetes national institutes and a database of government-sponsored patients enrolled in the National Programme of Treatment. These patients formed the database for the mDiabetes programme.

Self-registration was encouraged through two mobile numbers listed on all promotional materials. Diabetes patients had the option to register by sending either a text or WhatsApp message, by a call to either of the two numbers or by registering through the MoH website.

4

Technology specifications

This chapter contains essential guidance on setting up a reliable technology platform that is appropriate for the context of the mOralHealth programme being implemented.

4 Technology specifications

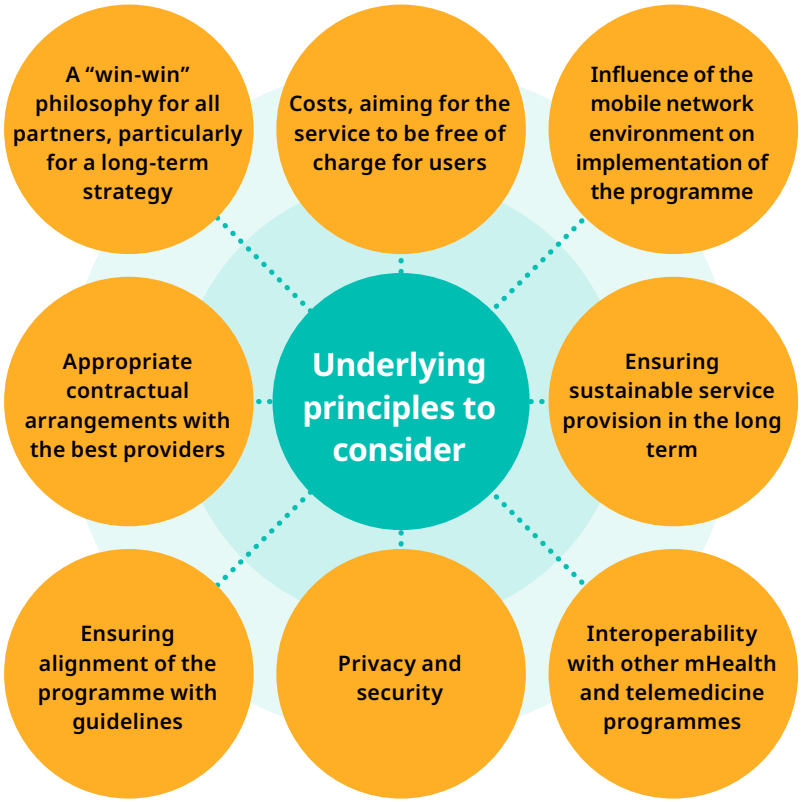
The following technical aspects of an mOralHealth programme, including their scalability and feasibility, must be considered by the TAG from the start:

- type of mOralHealth intervention and channels to be used (SMS, voice, apps, video, intraoral cameras)
- availability of technology options in the public or private sectors
- process for procuring and adapting technology
- negotiation with telecoms regulators, aggregators and operators for pricing
- data security
- review and clearance by appropriate ethics or regulatory bodies
- technology pretesting and scale-up plans.

Several underlying principles should be considered by the TAG when setting up mOralHealth technology that will help guide planning (**Fig. 4**).

FIG. 4.

Underlying principles to be considered in setting up mHealth technology



When thinking about the technical aspects of an mOralHealth programme, the TAG may consider the following questions.

- **Technology type:** Should the literacy module use text-based, interactive messaging for basic mobile phones? How can the training module provide e-learning content to the target group? What early detection and diagnostics technology is realistic and sustainable? Should surveillance on oral health be improved? What are the capacity, cost–effectiveness and reach of the available technologies in the country? What are the cultural, demographic and socioeconomic factors that may influence technology use?
- **Free access:** How can the programme be made free and available to all members of the target groups regardless of their carrier, network or location?
- **Research:** Who will conduct research on process, outcomes and impact of the programme?
- **Data ownership, privacy and security:** What are the considerations to ensure that data are handled safely and securely, protecting privacy and confidentiality of users?
- **Interoperability:** Are there other mHealth programmes that have been developed that this programme could be integrated with? Is there a BHBM programme already developed that could be adapted for this context? Is there already a platform (e.g., SMS, web, app) that could be used?
- **Partnerships:** What sort of arrangement with telecoms companies, public institutions and/or private-sector companies will best suit long-term implementation of the programme?
- **Sustainability:** What are the operating costs of the programme, such as costs for platforms/servers, maintenance, human resources and the like, and how will these affect the programme?
- **Scalability:** What is the potential of the programme to support or provide a platform for other mHealth interventions in a country? Can the service be leveraged in the future for projects or tasks beyond the immediate scope of the programme (**see Box 4**)? What additional advantages can the programme provide to a broader range of stakeholders?
- **Contracts:** In establishing contractual arrangements with partners, what are the issues regarding intellectual property, security and privacy of data (including mobile phone numbers), testing, expectations of involvement in M&E and service agreements? Who will hold the contractual arrangements, and what support will be given for maintenance and any other problems? What lessons can be drawn from previous experiences in other countries?

BOX 4:

An example of scalability: Tunisia in leveraging the mTobaccoCessation/mDiabetes BHBM platform for COVID-19 response

Amidst the COVID-19 outbreak in Tunisia, the government was able to quickly repurpose its functioning BHBM mDiabetes programme to support awareness raising and dissemination of preventive advice. A short series of messages was sent to over 10 million people, and an interactive messaging service was set up to follow up with inbound travellers during the period of the mandatory quarantine.

The TAG should also consider the detailed logistics and functional plan and finalize the functional specifications. This should be done in collaboration with the technical partners who will build the appropriate systems and interfaces and test internal and user acceptance. **Table 8** provides an overview of the roles of the various stakeholders when determining the logistics of the system.

TABLE 8.

Roles of stakeholders in setting up mHealth technology

Stakeholder	Potential roles
Ministry of Health	• Official owner and custodian of an mOralHealth programme and part of the governing body • Assesses and identifies needs and develops and validates content • Contracts service providers or builds in-house infrastructure or a platform • Signs cooperation agreements with all operators and/or service providers • Provides funding for the programme • Hosts the platform and databases • Owns the short code (the unique number used to send and receive SMS messages) to and from mobile phones (for SMS programmes) • Manages the promotion and marketing campaigns
Telecommunications ministry e-government (e-gov) entity (if applicable)	• Policy-making to enable mobile and/or web services in terms of regulations and policies; part of the governing body • Provides funding for the programme • Provides technical expertise to the MoH • May host the platform • Facilitates dialogue between the MoH and ICT stakeholders • Supports negotiation of preferential prices for mobile and/or web services
Telecommunication regulatory authority	• Verifies eligibility for short code acquisition and allocation of short code (for SMS programmes) • Facilitates dialogue between the MoH and ICT stakeholders • Funds or partly funds the programme
Mobile and web service provider (if MoH or e-gov does not have a platform)	• Provides content management application and/or platform (for SMS or app-based programmes) • Manages and runs the platform • Manages the security of the application and platform • Provides 24-7 technical support • Deals with telecoms or network operators

Stakeholder	Potential roles
Telecoms or network operator	• Delivers SMS to end users (for SMS programmes) • Provides internet capacity to end users • Sets the cost (e.g., SMS, data) and agrees on special tariffs with the MoH, if possible • Helps identify and enrol specific audience groups • Facilitates interfacing with service providers (e.g., local aggregator) • Provides technical expertise around quality of the network and capacity to support the programme • Manages the security of the network for transfer of data • Supports promotion of the service
Local aggregator	• Provides an interface with all operators and manages relationships and the invoicing process (for SMS programmes) • Reports on services delivered or failed (for SMS programmes) • May own and manage the short code (for SMS programmes)
Data privacy commission	• Sets the rules for data protection • Enforces application of data protection regulations • Authorizes mHealth services if they respect data privacy • Authorizes data storage outside the country, if necessary
WHO and ITU	• Provide technical expertise and share experience from other countries • Help convene stakeholders

5

Monitoring and evaluation of mOralHealth programmes

This section of the handbook represents a compact guide. If further information is required, more comprehensive guidance is available in the WHO guide for digital health monitoring and evaluation *(61)*.

5 Monitoring and evaluation of mOralHealth programmes

M&E should be planned, resourced and integrated into routine programme management functions as an ongoing activity from the start of preparing an mOralHealth programme. There needs to be a designated person or team in charge of the M&E-related processes; if needed, seeking external support may be useful. Doing so will create a programme with clear outcomes and measurable benefits for all stakeholders.

Impact measurement of an mOralHealth programme is intended to inform decision-makers about progress, strengthen the programme moving forward and highlight the overall impact of the intervention. Conducting impact-related activities, such as M&E, facilitates the business case for scaling and generates information that will enable the introduction of other mHealth programmes in the country. It will also inform stakeholders, including those in other countries, about barriers, enablers and effectiveness.

5.1 Developing an M&E plan

At the start, stakeholders should determine the objectives of the programme, in this case, the ability of the mOralHealth programme to reach identified target groups, feasibility, effectiveness and efficiency of the respective interventions depending on the modules chosen. Based on these broad objectives, questions that will be answered through M&E can be developed. Such questions may include:

- Is the programme sufficiently resourced?
- Does the mHealth platform operate optimally?
- Is the programme running on target (budget and timelines)?
- How effective is the marketing campaign in reaching new users?
- Is the intervention easy to understand and accessible to users?
- How many people out of the target population did the programme reach?
- How many stayed for the programme's duration?
- Are users improving their knowledge or modifying their behaviour due to the programme?
- Are users increasing their use of oral health services?
- Are health workers improving their performance?

The M&E plan should be agreed to by the TAG. An overview of the steps for M&E is shown in **Fig. 5**.

BHBM recommends using a framework or logic model as a guide to planning the M&E process for digital health programmes *(63)*. This model can illustrate the presumed relationships among the programme's inputs, outputs, outcomes and impact.

- *Inputs* are the financial, human, material and intellectual resources used to develop and implement an intervention.
- *Activities* are undertaken in the delivery of an intervention and may include training courses or other capacity-building, software or hardware development, adapting content, partnership/negotiation meetings, programme promotion activities and the like.
- *Outputs* are the direct products/deliverables of process activities in an intervention.
- *Outcomes* refer to the intermediate changes that emerge as a result of inputs and processes.
- *Impact* can be defined as the medium- to long-term effects produced by an intervention on population health, health systems or other benefits.

An example of an mOralHealth literacy logic model is shown in **Fig. 6**.

FIG. 5.

Overview of necessary steps for M&E

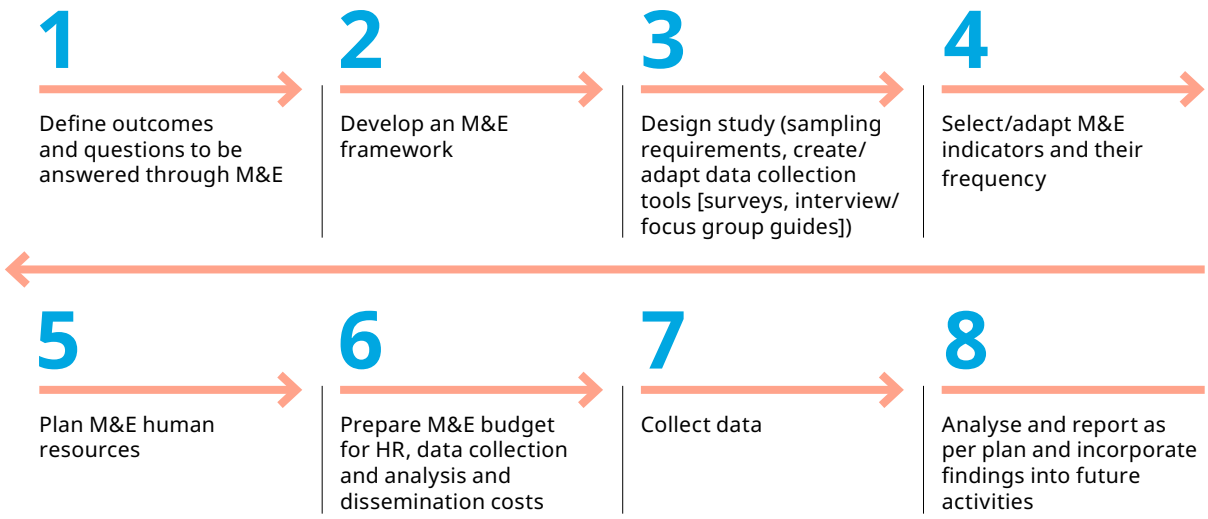


FIG. 6.

Example logic model of an mOralHealth literacy module

METHOD	ACTIVITIES	OUTPUTS	OUTCOMES	IMPACTS
Programme development resources **Staff** **Time** **Funding** **Partnerships** **Governance** **Policy change (if necessary)** **Operations and stakeholder management**	• Needs assessment • Content adaptation (incl. user testing) • Programme design • Technology development (incl. testing) • Negotiation for free/low-cost messaging • Health worker training • Outreach and promotion	• Baseline data from needs assessment • Quality adapted content • Programme specifications • Functioning message platform • Low-cost/ free two-way messaging • Trained health workers • Promotion activities • Analytics on reach of promotion • Users enrolled • Messages sent and received • Health workers trained	• Increased oral health literacy • Comparison of baseline and post data • User satisfaction of programme • User engagement • Technology performance • Knowledge gains • Behaviour change • Target user satisfaction from promotion activities • Systematic change in policy or health service delivery	• Improved oral health on a population level • Cost savings • Decrease in health burden • Increase in productivity
Process M&E			Outcome evaluation	

The overall impact of an mHealth programme at scale is its contribution towards the achievement of the SDGs, in particular SDG 3: "Ensure healthy lives and promote well-being for all at all ages" and SDG 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". Measuring the impact of a scale programme may not be feasible for most settings. Impact indicators pose significant attribution challenges and necessitate considerable investment of funds and time. For these reasons, this handbook focuses on process (activities) and outcome indicators. M&E of both process and outcomes levels are useful, as they give different insights into the programme.

5.1.1 Process monitoring

Implementers of all mHealth programmes should conduct routine process monitoring for the purposes of good programme management. Process monitoring tends to be carried out internally and regularly (monthly or quarterly) and provides information for planning and feedback about the progress of the project.

Monitoring reports and dashboards can provide a quick overview for evaluating the programme's objectives.

Monitoring should start at the programme's inception, and a routine reporting mechanism will need to be set up to monitor the core indicators and key deliverables. In some countries with more sophisticated web-based platforms, the monitoring report might be presented as a data dashboard. Monitoring reports and dashboards are helpful in providing a quick overview to see whether a programme is on track to reach its objectives.

These routine data should be analysed on a regular basis to understand progress and give feedback to programme staff, the TAG and other key stakeholders. They should look at all broad factors such as participation, technical errors and activity. Questions to discuss may include:

- Is the month's number of new registrants/ users consistent with past months and comparable to this time last year? If not, what events might explain a higher or lower number? Who can help increase participation?
- Are all modules of the programme being delivered as planned? What factors might explain any technical problems? What is the team doing to reduce technical problems?

5.1.2 Process evaluation

Process evaluation is the periodic assessment of the implementation of a programme in relation to planned activities and their overall objectives. It identifies the constraints that hinder the programme in achieving its objectives and can help to provide solutions that can then be implemented. Process evaluation tends to be carried out annually and uses a range of data collection methods. These can include simple recording of the completion of key activities, use of service analytics (e.g., to understand the flow of content between the programme and user) as per the telecoms company reporting or conducting focus groups and interviews for in-depth exploration of experiences, attitudes and ideas.

5.1.3 Outcome evaluation

An outcome evaluation is a type of evaluation that is concerned with determining if and by how much a programme's activities achieved its intended targets. It tracks information directly related to a programme's users, such as changes in biological markers, knowledge or behaviours. It can be an important investment to analyse and communicate the effectiveness of the program. In terms of designing the evaluation, the two major considerations are data collection methodology and study design.

Suggested methods of data collection for a robust evaluation of an mHealth intervention include surveys of users and clinical examinations, among others. A survey is suggested to assess the self-reported perceptions, behaviours, knowledge and attitudes of registered users.

5.2 Relevant indicators and collection methods

Relevant indicators allow answering of questions about the implementation process and overall achievements of the mOralHealth programme. WHO defines an *indicator* as a quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention *(62)*.

When planning an mOralHealth programme, think about the type of input, output, process and impact indicators, possible data sources available in the local context and frequency of measurements. It is important to strike the balance between feasibility of data collection and utility of data to provide feedback and improve the programme. **Annex 5** provides an indicator matrix with suggested mOralHealth indicators that programmes should routinely collect and report (including to the BHBM secretariat if the programme is supported by BHBM). The annex presents indicators as well as comments and suggested data collection and reporting frequency.

BHBM recommends setting up a routine reporting mechanism to monitor the core indicators and key objectives. In countries where web-based platforms can be developed, creating a real-time online dashboard supports regular monitoring of the programme. Some core indicators apply to all mHealth programmes, such as “reach and registration”, “information about the user population” and “feasibility of the programme”. Core indicators specific to an mOralHealth programme depend on local context and target groups.

Monitoring reports and dashboards can provide a quick overview for evaluating the programme’s objectives. Monitoring reports are usually designed for programme managers and decision-makers to assess progress and adjust the programme when needed. The raw data will include a wealth of information, and data management should be discussed beforehand. At this point, it will also be important to agree on the frequency of report updating, methods of analysis, presentation of the consolidated information on the dashboard and access issues. Some questions for consideration include:

- Which of the report indicators can be automated?
- What will be the frequency of data collection for the indicators?
- What will be the format for analysing data that are not featured on the dashboard?

There are a range of possible study designs that could be used for mHealth evaluations, both qualitative and quantitative (**see Table 9**).

TABLE 9.

Methods and data for mHealth evaluation

Method	Purpose	Considerations and examples
Survey	Assess the perceptions, behaviours, knowledge, attitudes and intentions of registered users.	• Can be administered on the Web, on a mobile device (recommended), or by an interviewer over the phone or in person • Should be as short as possible and employ multiple-choice yes/no questions wherever possible (see **Annex 5** for examples)
Focus group	Deepen understanding of users' experiences and explore the factors that may affect the user experience, such as language ability, gender, age, geographical location etc.	• Conducted by a facilitator in groups of 5-8 people • Can also be used to brainstorm ideas for increasing registration, improving the programme and enhancing desired outcomes
Interview	Interviews with users: qualitative feedback on their experience, perceptions and satisfaction with the mOralHealth Programme implementers: information on perceived strengths, weaknesses and needs related to programme delivery, processes, staff and management structures, capacity and communications methods	• For qualitative methodology of focus groups and interview, refer to *(46)*
Objective measure of outcomes	Collect data on biomechanical or physiological outcomes of performing behaviours, often collected in real time	• Literature searches can help identify objective assessment methods for relevant health behaviours • Examples include devices such as accelerometers or pedometers to measure physical activity, and saliva cotinine test to prove smoking cessation • Appointments made and held • If it is not feasible to collect objective measures for all participants, the measures could be used on a subsample of the mOralHealth user group, which can be generalized to the total sample after demographic matching
Cost analysis	Compare the cost per user of the mHealth approach with traditional approaches to reaching people in similar oral health programmes	• Collect costs on items such as development/planning, staff, marketing and technology

The following methods have been used in other BHBM programme evaluations:

- A *post-intervention survey* is a survey that is carried out over the telephone in a structured interview, online in a self-report form or as a series of questions and responses using the programme medium (SMS, messenger app, etc.). One questionnaire is administered after the user has finished the intervention. Without baseline data, however, it is difficult to determine causality, which impacts negatively on the study's quality, as there is no preprogramme information to make a comparison with. The questionnaire can gather both qualitative and quantitative data. This is likely the cheapest way to gather evaluation data from users.
- In a *pre-post study*, a survey or other measurement is assessed before a user starts the intervention, and then the user completes the same survey or measure after the intervention. Preintervention measures (baseline measures) are taken after registration but before the programme starts. This enables a comparison between the baseline measure and post-measure in the same participant, meaning that causality is more likely to be inferred than from a post-intervention survey alone. To minimize the burden on users, it may be feasible to deliver M&E questions via mobile phone (e.g., SMS messages). **Fig. 7** gives an example of how evaluation questions can be delivered via messaging at baseline and follow-up.
- A *longitudinal cohort study* follows a group of similar individuals (cohort) over time. Participants differ with respect to certain factors under study to see how these factors may affect certain outcomes.
- A *randomized controlled trial* divides the study population randomly into two groups: a group that receives the intervention (the intervention group) and a group that does not (control group). This study design is often considered the gold standard of robustness in research, although it may not be the most appropriate for evaluating scale programmes. Randomized controlled trials are expensive, and their coverage will be limited. In past BHBM programmes, they have been used to evaluate a pilot programme, providing robust proof of concept, but they are not recommended for scale evaluation.

This is not an exhaustive list of possible evaluation designs. Considering required resources versus learnings, BHBM suggests carrying out pre-post studies or evaluation studies on a subset of the users. For these, you will need to collect the same data before and after the program. All of these methods use surveys, either provided through the mHealth technology (SMS or messenger apps) or conducted over the telephone.

Studies may require review and clearance by an ethical review committee; thus, it is important to check the country's laws and regulations. The review may be conducted by national or local ethics committees or by other stakeholder institutions with formal ethics approval systems.

FIG. 7.

Example survey question (Q) delivered by mobile phone

5.3 Data analysis, reporting and dissemination

After data are collected, thorough analysis provides insights and answers to the initial questions developed as part of the M&E plan. Analysis could mean calculating simple percentages, collating qualitative data into themes or, if the quantitative data is robust enough, running statistical tests on the data. Involving someone in the data division of the implementing organization in case of uncertainties with data analysis or approaching the BHBM country support team can help. The results of the data analysis should allow the objectives of the programme to be assessed and substantiated.

Analysis results should be consistently reported to provide feedback that is relevant for the respective stakeholders, such as the programme manager or other decision-makers. Data should be presented in a short and user-friendly manner. It should be used to support collaboration and decision-making among stakeholders regarding ongoing resource allocation and processes for the programme's future. For example, if the data show irregularities in registration, delivery of messages or user responses, then such issues must be brought up to the concerned decision-makers through regular review meetings. In addition, these data should feed into the annual process and outcome evaluation report to show progress and share lessons learned.

M&E findings should be disseminated in an accessible and timely manner through:

- formal and informal networks via meetings, newsletters and other forums
- professional conferences via discussion papers or posters
- journals (scientific or lay)
- electronic media, such as web pages, social media and e-mail.

All M&E findings should be incorporated into programme management to improve the mHealth service.

Conclusion

Oral diseases are widespread and greatly impact the health and well-being as well as compromise the social interactions and economic productivity of those affected. Utilization of mobile technologies in health has increasingly been shown to enhance existing approaches to improve general health. It also holds great potential to improve oral health and prevent and manage oral diseases.

This handbook provides guidance for developing and implementing an mOralHealth programme to improve oral health and prevent and control oral diseases. It consists of four modules with different interventions targeting several target groups.

- The mOralHealth literacy module focuses on empowering individuals and communities by strengthening their oral health literacy. It also fosters awareness and advocacy of the importance of oral health among policy-makers, decision-makers, the media and CSOs to increase its visibility and prioritization.
- The mOralHealth training module encourages the employment of mobile technologies for training approaches to enhance the knowledge and skills of general health professionals as well as raise awareness of the global oral health agenda and priority oral health interventions among oral health professionals.
- The mOralHealth early detection module provides helpful considerations for using remote detection and diagnostics tools, which are increasingly being used to facilitate access to and improve quality of health care services.
- The mOralHealth surveillance module informs about the use of mobile technologies in the context of strengthening oral health surveillance systems and collecting epidemiological data, as well as monitoring quality patient care and service delivery.

All modules are complementary and mutually enhancing. Each module can be implemented as a stand-alone intervention or in combination with other modules.

When approaches from this handbook are incorporated into existing health systems, policies and interventions, mOralHealth can enhance, complement and reinforce ongoing efforts to improve oral health. This handbook provides a comprehensive framework and guidance for governments that wish to integrate an mOralHealth programme into their national health system, outlining steps in five programmatic areas: operations management, content development and adaptation, technology, promotion and recruitment, and M&E. Realistic planning of and assessing an mOralHealth programme to also know about its limitations are important, as the programme cannot replace but should rather enhance existing interventions.

Adaptation and contextualization of the mOralHealth programme to the setting where it will be implemented are absolutely key to aligning the programme with the existing health system so that it can address the needs of potential target groups and be sustainable based on available resources, among other aspects. This includes considering how to reach vulnerable groups to decrease inequalities. Case studies throughout the handbook illustrate how oral health literacy, training, early detection and surveillance have been implemented in different settings.

All governments are encouraged to share their experiences with implementing an mOralHealth programme with the BHBM initiative to collect further insights and learnings for the benefit of other countries planning to implement such a programme.

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Annexes

Annex 1. Additional examples of mHealth programmes promoting oral health

Programme (country)	Objective of the programme	Description	Advantages and disadvantages	Links/Resources
E-DENT (France)	To identify oral lesions that would have remained undetected or untreated and to improve the medical coordination and optimize patients' pathways.	E-DENT is a teledentistry system to support remote oral diagnosis using intraoral cameras for different kind of patients: elderly people, people with disabilities, detainees or people in prison, etc.	Some hesitation and resistance were observed among carers in homes for elderly, owing to a lack of technology skills. After equipment had been introduced, however, their attitude towards it changed. Implementation and improvement of the programme continues.	Inquimbert C, Malthierry E, Arzens G, Camman P, Charvier M, Cuisinier F, et al. Teledentistry in France: example of the e-DENT Project. In: Giraudeau N, editor. e-Health care in dentistry and oral medicine. Springer, Cham; 2018:143–54. doi:10.1007/978-3-319-69450-4_12. Giraudeau N, Valcarcel J, Tassery H, Levallois B, Cuisinier F, Tramini P, et al. Projet e-DENT: téléconsultation bucco-dentaire en EHPAD. Eur Res Telemed Rech Eur En Télémédecine. 2014;3(2):51–6.
WhiteTeeth (The Netherlands)	To promote good oral health behaviour (i.e., increasing exposure to fluoride and improving dental plaque levels), thereby improving oral health and reducing costs.	WhiteTeeth is a theory-based mobile app for promoting oral health behaviour in addition to usual care for adolescent orthodontic patients. The app provides oral health education and automatic coaching through action and coping plans, cues to action, prompts, reminders, reinforcement and feedback.	App development was guided by the intervention mapping protocol thus based on sound evidence and incorporating several BCTs. Mapping the development and content of the app allows researchers to replicate the programme. Results of a randomized controlled trial showed that the app in addition to usual care significantly improved patients' oral hygiene. The attenuated effect on mouth-rinse use may have been due to the fact that, after six weeks, most patients used the app less often. Implementation and improvement of the programme continues.	Scheerman JFM, van Empelen P, van Loveren C, van Meijel B. A mobile app (WhiteTeeth) to promote good oral health behavior among Dutch adolescents with fixed orthodontic appliances: intervention mapping approach. JMIR mHealth and uHealth. 2018;6(8), e163. Scheerman JFM, van Meijel B, van Empelen P, Verrips GHW, van Loveren C, Twisk JWR, et al. The effect of using a mobile application ("WhiteTeeth") on improving oral hygiene: a randomized controlled trial. Int J Dent Hyg. 2019. doi: 10.1111/idh.12415.

Programme (country)	Objective of the programme	Description	Advantages and disadvantages	Links/Resources
EstomatoNet (Brazil)	To provide support for clinical practice, give diagnosis and management advice to practitioners and prevent unnecessary referrals to higher levels of care, thereby reducing costs and supporting management of low-complexity cases at the primary care level.	EstomatoNet is a telehealth service that provides synchronous and asynchronous teleconsultations, telediagnosis services, webinars, distance learning, tele-education and formative second opinions.	Telediagnosis for oral lesions is feasible and has potential to improve the quality of PHC by bridging the gap between primary and specialized health care. Challenges to telehealth persist, however, and include the availability of stable, good quality internet connections, lack of data and clinical photographs, and low telehealth uptake among dentists.	Carrard VC, Martins MA, Molina-Bastos CG, Concalves MR. WhatsApp: a telemedicine platform for facilitating remote oral medicine consultation and improving clinical examinations – some considerations. Oral Surg Oral Med Oral Pathol Oral Radiol, 2017;123(3):408. Bavaresco CS, Braganca SG, DÁvila Op, Umpierre R, Harzheim E, Rodrigues JA. Pediatric dentistry in primary healthcare: creation, development and evaluation of a distance education course. Telemed J E Health. 2018;24(8)624–30. Haddad AE, Skelton-Macedo MC, Abdala V, Bavaresco C, Mengehel D, Abdala CG, et al. Formative second opinion: qualifying health professionals for the unified health system through Brazilian telehealth program. Telemed J E Health. 2015;21(2):138–42.
Oregon Telehealth Network for Oral Health (USA)	To reach children who have not received regular dental care through schools and to disseminate the Virtual Dental Home (VDH) concept throughout Oregon. The VDH aims to reduce the need for most children to be seen by a dentist in stationary dental clinics.	Mobile dental teams comprising an expanded-practice dental hygienist and assistant screen children and submit the data to a cloud-based electronic health record so that collaborating dentists can examine the children. The diagnosis and treatment plans are returned to the dental team, which either conducts the treatment or refers the child to a dentist.	The VDH enables delivery of oral health services in nontraditional settings using nondental professionals, expanding roles for existing dental professionals and new types of dental professionals, and incorporating telehealth technologies. Multiple barriers to wider deployment of telehealth included confusing or contradictory definitions of telehealth, uncertainty of payment for services, difficulties in developing and sustaining networks, the challenge of integrating technology among providers and lack of training resources.	Glassman P, Harrington M, Namakian M, Subar P. The Virtual Dental Home: bringing oral health to vulnerable and unserved populations. J Calif Dent Assoc. 2012; 40(7):569–77. Glassman P, Helgeson M, Kattlove J. Using telehealth technologies to improve oral health for vulnerable and underserved populations. J Calif Dent Assoc. 2012; 40(7):579–89. Kohli R, Clemens J, Mann L, Newton M, Glassman P, Schwarz E. Training dental hygienists to place interim therapeutic restorations in a school-based teledentistry program: Oregon's Virtual Dental Home. J Public Health Dent. 2021;81.

Programme (country)	Objective of the programme	Description	Advantages and disadvantages	Links/Resources
Oral-health programme using social media (Iran)	To promote good oral hygiene behaviour and thereby improve oral health outcomes among Iranian adolescents.	A theory-based programme was delivered by a social media platform (Telegram). The programme included several BCTs that targeted a range of behavioural determinants. It provided information about poor oral hygiene practices and positive consequences of daily toothbrushing. Adolescents were encouraged to formulate their own potential pros and cons of regular toothbrushing and to make concrete plans. Further, instructions on and role modelling of effective behaviours (via a short video) were provided. A Telegram channel was also created for mothers that instructed them to coach and monitor their children's behaviour.	Results of an experimental study support the use of the theory-based programme delivered by Telegram to improve good oral hygiene behaviour and oral health outcomes among Iranian adolescents. The study also highlighted that involving mothers in the process resulted in better outcomes in terms of oral hygiene practices and oral health. To give more insight into how mothers influence the effectiveness of the intervention, future studies should measure the extent to which mothers are involved in the experiment, such as how often mothers supported and monitored their children's behaviour.	Scheerman JFM, Hamilton K, Sharif MO, Lindmark U, Pakpour AH. A theory-based intervention delivered by an online social media platform to promote oral health among Iranian adolescents: a cluster randomized controlled trial. Psychol Health (in press).
e-DantSeva – the National Dental Portal (India)	To raise public awareness about the significance of maintaining optimal oral health and provide the tools and knowledge to do so.	The portal has a variety of features, such an A-Z list of oral health topics, including common dental diseases and their treatments and information on myths and facts about oral health. It also has interactive sections, such as games, a quiz, self-examination tools, videos and a symptom checker. The portal includes a distinct "find dental facility" feature, listing all the dental teaching institutes and governmental hospitals across the country.	Results from a qualitative evaluation showed that most of the participants were satisfied with the website e-DantSeva. Participants suggested creating a regional language interface for easier navigation, including an online chatting session with experts and enabling personal accounts so they can receive personalized messages.	e-DantSeva [website]. NOHP, MOHFW, Government of India; 2021 (http://edantseva.gov.in/, accessed 28 May 2021).

Programme (country)	Objective of the programme	Description	Advantages and disadvantages	Links/Resources
Text2floss (USA)	To promote good oral health knowledge and behaviour in mothers of young children.	Text2floss is a seven-day text messaging intervention (two-way SMS service) to improve oral health knowledge and behaviour in mothers of young children.	According to a feasibility study, mothers receiving text messages improved their own oral health behaviours and knowledge as well as their behaviours regarding their children's oral health. Using text messages to remind about flossing and deliver oral health information was considered acceptable. Participation was limited, as some mothers were deemed ineligible because their wireless carriers were unable to receive Text2Floss messages.	Hashemian TS, Kritz-Silverstein D, Baker R. Text2Floss: the feasibility and acceptability of a text messaging intervention to improve oral health behavior and knowledge. J Public Health Dent. 2015;75(1):34–41.
Dental Coach (The Netherlands)	To improve adherence to oral health instructions of patients who are suffering from dental diseases (such as periodontitis).	Dental coach (mondmaatje) is an online platform made available to patients via their caregivers, e.g., periodontologists. Enrolment into the mHealth programme occurs by scanning a QR code in the dental clinic. As a result, the app on the mobile phone of the patient is activated. The app allows patients to access their medical files, gives insights into their oral health risks, summarizes personal oral health instructions, demonstrates desired behaviour using videos and coaches patients to change their oral health behaviours by self-monitoring of behaviour and providing practical support.	According to a cross-sectional study, most of the participants evaluated the content and appeal of the app as positive. Although Dental Coach's usability was rated as moderate, its use triggered a self-reported positive change in oral health behaviour. Future research is needed to determine whether this self-reported behaviour change translates into better oral health.	Dental Coach [website]. 2021 (https://www.dentalcoach.app/en/, accessed 28 May 2021). Scheerman J, Giraudeau N, El-kadi I, De Groot J, Aa S, Van Meijel B, et al. The dental-coach app: its usability and patients' oral-health behaviour change. IADR/AADR/CADR General Session; 2020 (https://iadr.abstractarchives.com/abstract/20iags-3319938/the-dental-coach-app-its-usability-and-patients-oral-health-behavior-change, accessed 28 May 2021).

Annex 2. mOralHealth literacy programme content libraries (available on request bhbm@who.int)

Literacy programme content libraries are available on request from bhbm@who.int.

mOralHealth literacy message library overview	
Goals of the programme	Improve oral health literacy and increase the good oral health behaviour of communities. Potential outcomes include: 1. improved quality and frequency of oral health behaviour 2. increased understanding of good oral care products 3. increased understanding of the importance of oral care 4. increased awareness of common risk factors for poor oral health (tobacco use, harmful alcohol use, unhealthy diet).
Target audience	General population. In addition, messages are designed for those from the following specific groups: • parents/primary caregivers as proxy targets to reach children aged 3–9 years • teachers as proxy targets to reach children aged 3–9 years • people who are pregnant or breastfeeding • adolescents • populations with specific needs (e.g., ageing, diabetes, cancer, disabilities). Consent from end users to receive the messages should be obtained before messages are delivered; this is especially important for sensitive topics or specific health conditions (e.g., HIV, diabetes).
Message delivery modality	Messages have been designed for SMS delivery but are adaptable for delivery via other modalities, including app messaging and social media (see **Annex 4**).
Content of the messages	BCTs were used to underpin the mOralHealth program. Each message is categorized into one of four domains: motivation, support, information or reminders. Messages are designed to be clear and direct, offering practical and relevant advice in simple language to those with lower health literacy. Messages are positively framed, focusing on emphasizing the benefits of action.
Programme algorithm	The programme is designed to be approximately three months in duration (12 weeks), with messages starting at a high frequency and decreasing frequency over time. Message delivery timing should vary each day.

mOralHealth literacy message library overview	
Local tailoring	The specific behaviours targeted and information included in the messages should be guided by national and international oral health guidelines. Local/national terminology should be used where possible (e.g., fizzy drink, soda). This includes references to dental health professionals. For example, where dentists are not available, the names of local professionals able to provide dental care should be used. Details and links (or phone numbers) should be included in messages referring people to dental services. These services should preferably be free or affordable and accessible. Where [service link] or [service number] is included in a message, this should be replaced by a website or phone number. Where available and accessible, references to specific tools (e.g., apps, games) can be added to the messages. Where possible, messages should be personalized. Examples include: • adding local greetings to the start of messages • adding the recipient's name to the start of the messages (e.g., "Hi, Amanda"). • adding the child's name to replace "your child" in the messages (for parent programmes). Additionally, initial formative work should investigate important aspects of the target culture(s) for adapting and tailoring of the messages. This could include: • cultural norms around oral health • oral health myths common within the culture • motivations for behaviour change relevant to the cultural context.

Suggested mOralHealth algorithms and message libraries

The mOralHealth programme is designed to include 46 messages delivered over a three-month period. The specific 46 messages are chosen from the mOralHealth library depending on the target audience. The library consists of a total of 246 messages categorized by target group:

- 74 general messages: Messages OH1–OH74
- 46 messages for parents (as proxy targets to reach children aged 3–9 years): Messages PA1–PA46
- 46 messages for teachers (as proxy targets to reach children aged 3–9 years): Messages TA1–TA46
- 20 messages for people who are pregnant or breastfeeding: Messages PR1–PR13 and BF1–BF7
- 18 messages for adolescents: Messages AD1–AD18
- 42 messages for populations with specific needs:
  - 14 messages for ageing populations: Messages AGH1–AG12
  - 4 messages specific to people with disabilities: Messages DS1–DS3
  - 6 messages specific to people with diabetes: Messages DI1–DI6
  - 1 message specific to people with chronic respiratory conditions: Message CR1
  - 4 messages specific to people with HIV: Messages HI1–HI4
  - 6 messages specific to people undergoing cancer treatment: Messages CA1–CA6
  - 5 messages specific to areas where noma is common: Messages NO1–NO5
  - 2 messages specific to populations where betel nut is common: Message BE1–BE2

Example messages

Message libraries are available on request from bhbm@who.int.

Example messages for the general population

Do you forget to brush your teeth? Planning ahead helps. Plan to do it around key events in your day, e.g., after taking a shower or right before going to bed.*

**Add local examples where appropriate (e.g., prayer times).*

After brushing, spit out the toothpaste foam. You don't need to rinse your mouth out afterwards because the foam releases fluoride, which strengthens your teeth.

Take care of your teeth! Don't brush too hard, avoid grinding your teeth, and limit sugary and acidic foods and drinks. This will prevent damage to your teeth.

It is common to forget to take good care of ourselves when we are stressed. Remember that brushing your teeth is still important during these times.

Example messages for parents of children aged 3–9 years

Starting good oral health practices in childhood will give your child the best chance of carrying these habits through to adulthood.

The best drink option for children is water. Try to avoid sugary and fizzy drinks or fruit juice to reduce the risk of tooth decay.

Issues with teeth can affect a child's speech, eating, confidence and self-esteem. Regular checkups with a dentist will help to identify issues early.

Why not make up a song for your child to brush their teeth to? Aim for two minutes so they know how long to brush for. This can make toothbrushing time more fun.

Example messages for teachers of children aged 3–9 years

Children spend a lot of time at school, so it is the perfect opportunity to teach them healthy oral-hygiene habits and other health behaviours.

Protect children's teeth when playing sports to prevent injuries to the head, neck and mouth; for example, use mouthguards for contact sports and helmets when cycling.

Schools are important to support children to learn good oral hygiene habits and other healthy behaviours like washing hands with soap.

Example messages for adolescents

Keep your smile looking good by protecting your teeth with a mouthguard or face mask if you are playing contact sports.

Taking care of your teeth and mouth is essential for your future health. Good oral health makes you feel good, remain pain free and have fresh breath.*

*Add locally relevant motivators if necessary.

Smoking, drinking alcohol and using drugs can lead to poor oral health (e.g., bad breath, stained teeth, oral cancer). Avoid these things for a healthy smile.

Example messages for people who are pregnant or breastfeeding

Vomiting from morning sickness increases the acid in your mouth, which can cause tooth decay. Rinse your mouth with water regularly to help protect your teeth.

It is important to take good care of your oral health during pregnancy. Changes in pregnancy hormones make your gums more likely to be tender or sore or to bleed.

Breastfeeding for at least six months can prevent your baby from developing problems with their bite (e.g., overbite).

Make sure you continue to eat a healthy diet with plenty of calcium while breastfeeding to keep your bones and teeth healthy.

There are additional messages specific to the needs of the following groups:

- older adults (ageing populations)
- people with disabilities
- people with diabetes
- people undergoing treatment for cancer
- people with HIV
- people with chronic respiratory conditions
- areas with high prevalence of noma
- areas where betel nut products are used

Annex 3. Main themes and operationalizing strategies for message development

Main strategies based on themes	Operationalizing strategies for message development based on subthemes	Behaviour change condition affected
Use positively framed advocacies, as they are more persuasive; avoid negative or nonaffirming framing of advocacies.	Empower and ease stress by pointing to successes.	Motivation
	Inspire and show respect for receivers.	
	Show compatibility with positive indigenous views of health as "living a good life".	
Avoid fear- or stress-inducing messages.	Show respect for autonomy.	Motivation
	Authoritarian messages may be perceived as lacking in respect, invoke historic distrust issues with the colonial or medical system and cause defiant response.	Motivation
	Provide healthy lifestyle education messages.	Motivation
Build on healthy cultural and traditional practices whenever possible; avoid incongruity with cultural and traditional practices.	Empower with a strengths-based approach to local culture.	Capability, opportunity, motivation
	Show respect for culture.	Capability, opportunity, motivation
Recognize social determinants of health as drivers of the ability to adopt behaviours; avoid disconnect with the reality of social determinants of health and the diversity of cultures within a population.	Consider cultural settings and cultural norms related to lifestyle.	Capability, opportunity
	Understand affordability and accessibility of foods and medications.	Capability, opportunity
	Consider access to providers and/or medications in the health care system.	Capability, opportunity
Ensure pragmatic content within the local setting; avoid lack of clarity and lack of practicality of content.	Give preference for practical tips over higher level advice.	Capability
	Avoid ambiguity in wording and assumptions.	Capability
	Consider and check the local dialect in translation.	Capability

Source: Reprinted from Maar MA, Yeates K, Toth Z et al. Unpacking the black box: a formative research approach to the development of theory-driven, evidence-based and culturally safe text messages in mobile health interventions. JMIR Mhealth Uhealth. 2016;4(1):e10.

Annex 4. Adapting content to other technologies

The mOralHealth literacy content library is in SMS format as an equitable mode of dissemination of mobile messaging. The library can easily be adapted to free-phone voice messages, which are a good way to get messages to populations with low literacy or visual impairment. However, if your needs assessment and inputs from target users of the programme suggest that it may be impactful to provide the programme through smartphone apps in addition to SMS, you may adapt the content library to a messenger app (as normal instant messages or in chatbot format) or as a stand-alone app.

Adapting to voice messages

Interactive voice response (IVR) enables reaching those who may not be able to interact with text content. Either actors or software can be used to record the adapted messages in the BHBM content library, which can then be delivered by inbound or outbound phone calls to a smartphone or a feature phone. The call should be free of charge. With IVR, the user can input a response using key words (for example, voice: "Have you brushed your teeth today with fluoride toothpaste? Say YES or NO"; depending on the user's answer, an appropriate pre-recorded response is given by the voice).

Voice messages can be creative if that is appropriate for and engages the target users based on preferences indicated during the testing phase. A series of short one- to three-minute audio plays or stories could be developed to deliver the mOralHealth literacy content library via the telephone. Actors in a number of scenarios could be recorded engaged in a discussion (e.g., an oral health professional and a patient receiving information, advice or instruction or a trusted community member providing information or behaviour change strategies). When adapting the content of voice messages, the original intent of the message in the BHBM content library should be retained.

Adapting to messenger apps

According to a range of studies, people check their phones for messages and notifications between 50 and 100 times a day. Messaging through messenger apps like Facebook Messenger, WhatsApp, WeChat and Viber offers an opportunity to get your messages read and noticed, as these apps are commonly used in some cultures. Messenger apps also provide more freedom with the length of messages you can send and the different medias you can engage people with, such as audio files, images, GIFs and videos, external web links, or localization-based suggestions or content. They have restricted reach, however, limited to users who have smartphones.

The mOralHealth literacy content library should be used as a starting point. Additional details can be added to messages where the user may benefit from more clarity, while preserving the scientific fidelity of the original library. BHBM suggests asking for feedback from the target users on what they would likely engage with in terms of additional multimedia (e.g., images). See Table 10 for suggested multimedia dos and don'ts.

TABLE 10.

Multimedia dos and don'ts

Multimedia content dos	Multimedia content don'ts
Do ensure equal representation of men and women and different ethnic groups within your target population in all visual content.	Don't use stereotyped images of particular social groups.
Do consider the file size and data usage costs for users, avoiding heavy files and compressing image and video files if possible.	Don't use colours or gestures associated with a particular political or social group.
Do use a variety of relevant regional accents if possible in audio materials.	Don't use complicated infographics, graphs or other visual representations of information. Keep them simple.
Do try quizzes: they can be a fun way to engage, reward and collect data about knowledge gains and behaviour change.	**Don't accidentally place products in photographs or videos (e.g., a branded good in the background).**
Do be creative with content: try to use visuals alongside education messages (e.g., an **illustration of a culturally appropriate healthy meal alongside a nutrition instruction about healthy meals).**	

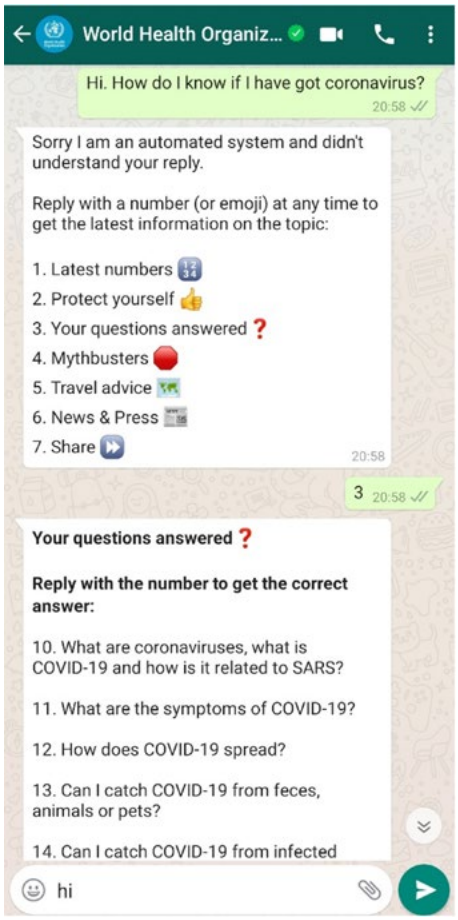
Conversational agents and conversationalizing content

To create a more interactive and tailored experience, a chatbot can be used. You should consider the user experience when designing the conversational scripts for the chatbot. It is expensive and can be imprecise and less feasible to use a natural language processing (NLP) chatbot because NLP incorporates an artificial intelligence (AI) system that has to be trained using lots of data and then maintained. Against this background, experience with some WHO bots shows that users have more conversational exchanges with an NLP bot.

A conversational interface chatbot (CIC) is much easier to set up than an NLP chatbot. A CIC chatbot presents limited input options for users to select using buttons or emojis or by typing the corresponding number or key word from a list of information topics. This results in the user navigating the chatbot and getting the tailored information they desire with less likelihood of the chatbot misunderstanding free-text inputs. Alternatively, there are hybrid chatbots that are predominantly CIC but have some basic NLP capabilities. See Fig. 8 for an example of a CIC (the WHO Health Alert service provided through WhatsApp).

FIG. 8.

Example navigation of the COVID-19 health alert chatbot



After the design of the possible topics and conversations has been finished, the accompanying audio files, images, videos or links can be made according to user preferences. Table 11 lists some dos and don'ts for creating chatbot conversations.

TABLE 11.

Chatbot dos and don'ts

Chatbot conversation dos	Chatbot conversation don'ts
Do keep messages short, simple and to the point.	Don't use casual fillers like in normal speech as these can be misinterpreted.
Do explain clearly how the user navigates (e.g., "select from the buttons below", "type the number of your desired response").	Don't be too chatty.
Do have the function to save the user's progress so that they can come back to the same point if they have to leave the conversation.	Don't overwhelm.
Do keep the goal of the bot in mind when writing the script.	Don't use humour unless you are sure it will be understood by all. It could create confusion.
Do be consistent with your voice and tone throughout the script and with tenses.	Don't request clarification on every input; only clarify important questions such as screening questions for tailoring purposes.
Do proofread and test your script for errors in the algorithm. It is essential that all content works smoothly.	Don't use emojis if multiple messenger apps will be used, as they can't be recognized over all platforms.
Do make sure it is obvious when a chat session is over and how and when the user can next engage.	
Do personalize either by writing all messages in the first person or by including a name or mascot for the service (characterizing the speaker).	

Transfer of the content library into an app

Evidence is lacking into the features of smartphone health apps that increase effectiveness. However, literature is emerging in this field. Apps should have an engaging design and be very easy to use and navigate. All instructions should be clear and concise. User testing is vital to creating an app that will be used and that will retain its users. Table 12 summarizes characteristics of apps found to be associated with positive user experience and engagement.

TABLE 12.
App characteristics linked to positive user ratings and app engagement

Features/content having positive impact on user ratings and/or increased use	
Content	Includes references to internal behaviour change drivers, such as motivation, self-efficacy, illness understanding and attribution (internal drivers)[a] Includes references to external behaviour change drivers, such as availability of information, the beliefs of peers and family, and the role of social networks[a]
Evidence	Strong evidence base and behaviour change theory
Service user and professional input	Ensures user compatibility and acceptability of app, especially at the design stage[a]
Clarity	Factors such as ease and simplicity of use, specific instructions, features that save time, accessibility, relevant functions and clear security features are also important with high ratings in app stores[b]
Incentives	Tangible and intangible rewards provided by the health app
Social competition	Competition with others (seeing other people using the app and sharing behavioural data that could be compared to others on social networking sites) and the ability to share personal information (sharing information with family or friends leads to informational and emotional social support)
Hedonic factors	A gaming element or entertaining feature
Trackers	Tracking for awareness and progress (built-in feature to track the user's activity, including diet, exercise and sensor-based automatic tracking)
Goal-setting features	Help users discipline themselves and slowly change their behaviours

a Fitzgerald M, McClelland T. What makes a mobile app successful in supporting health behaviour change. Health Educ J. 2017;76(3):373–81.

b Mendiola MF, Kalnicki M, Lindenauer S. Valuable features in mobile health apps for patients and consumers: content analysis of apps and user ratings. JMIR mHealth and uHealth. 2015;3(2):e40.

Annex 5. Example indicators for M&E of an mOralHealth programme

Note that these indicators are only a selection of possible indicators to monitor and evaluate an mOralHealth programme.

Indicator	Type	Comment	Data collection method	Frequency
Operations				
# of full-time equivalent persons working at leading agency on programme	Inputs	This gauges the human resources commitment from the leading implementation agency and will help to understand the cost of the programme.	Terms of reference of involved employees or verbally from team lead	Annually
# of full-time equivalent persons working at supporting agencies on programme	Inputs	This gauges the human resources commitment from supporting agencies and will help to understand the cost of the programme.	Terms of reference of involved employees or verbally from team lead	Annually
National TAG set up	Input	This records whether the team is functioning by month three.	Carried out: yes/no and composition	Y1, m3
Commitments for funding (USD) across contributors and the duration of each commitment	Input	Knowing where the funding is coming from, how much and for how long will help to identify whether more funding is needed and plan accordingly.	Qualitative description; may have to speak with others responsible for resource mobility	Annually
# of fundraising activities for sustainability	Process	This motivates to think about sustainability from the outset and nurture funding relationships throughout.	Carried out: yes/no and description	Annually
Budgeted plan produced for current and following year	Process	This should happen within the first three months.	Carried out: yes/no	Y1, m3, then annually
Budget spent	Input	A budget tracker, be it a Microsoft Excel spreadsheet or written report, is useful to monitor spending and plan ahead.	Main budgetary items in USD amounts	Quarterly (and cumulative)

Indicator	Type	Comment	Data collection method	Frequency
# of partnerships and names of partner organizations with supporting documentation, such as memorandums of understanding or terms of reference	Inputs	This will measure the interest and growth of the programme in terms of its partnership support from other government agencies, health services, the private sector and civil society.	This will be found in records or anecdotally from the programme manager.	Annually
Policy engagement and systemic change				
Description of policy engagement	Inputs/ process/ outputs	This qualitative indicator can describe the policy-level support to the programme or changes attributable to the programme. Describe the policy interaction with the programme over the last year (e.g., policy consultations held, policy-makers involved and speaking in programme meetings, number of policy briefs prepared, newsletters sent, actual policy change, etc.).	Maintain a record of such interactions and events.	Annually
Description of systemic change attributable to programme activities	Process/ outputs	This qualitative indicator can describe any changes to the health system as a result of programme activities over the last year. This may include other uses of acquired software or the content delivery platform, institutionalization of the programme, changes in referral mechanisms, changes in public awareness of the health topic, new synergies between partners or ministries, changes in process or procedures among partners due to the programme and so forth. This attempts to document added value of the programme.	This information can be gathered from the programme manager or the TAG.	Annually

Indicator	Type	Comment	Data collection method	Frequency
Programme performance – literacy				
Existence of programme specifications	Inputs	Have the programme design specifications been set, such as verifying the aims, adapting the logic model if necessary, and designing the length of programme and its rules?	Carried out: yes/no	End of second quarter
# of new messages developed/new app content or features	Process	This should be numeric if messages, description if app. (Please send any new content to BHBM secretariat [bhbm@who.int].)	Consult the content library as it evolves.	Annually
Messages adapted	Process	This may be relevant only to Year 1.	Carried out: yes/no	End of second quarter
Verification of fidelity of messages	Process	This may be relevant only to Year 1 and is optional.	Carried out: yes/no	End of second quarter
Content management system (CMS) set up and/or maintained	Process	The CMS may be as simple as a Microsoft Excel spreadsheet or Word document (and passed to telecoms companies or bot providers) or as advanced as an in-house software solution with an interoperable programming language. What is important is whether the CMS exists and is maintained.	Carried out: yes/no	Annually
# of users after programme launch	Output	This records the interest in the programme after the promotion campaign.	Service analytics	Week 2 postlaunch
# of new subscribers per month	Output	This helps to see if appetite for the programme is maintained and can help to determine if promotion strategies are achieving the aim of recruitment.	Service analytics	Monthly
% of users who shared the message content with others not enrolled in the programme	Output	This will assess additional reach of messages and can be used as an indication of the satisfaction with the content.	Surveys/message survey replies	M3 after launch and annually

Indicator	Type	Comment	Data collection method	Frequency
Estimate of the number of messages read by users	Output	Although messages are sent, receiving doesn't mean engaging, so it could be helpful to ask, "How many of the text messages did you read? (Select 1 only) 1 = None, I didn't receive any; 2 = None, I didn't read any; 3 = Some (less than half); 4 = Most (more than half); 5 = All or nearly all of the messages."	Surveys/message survey replies	Annually
% of users who increased their quiz scores pre- and postprogramme in knowledge quizzes (chatbots and apps)	Outcome	If content included quizzes, this looks at the change pre- and postprogramme in knowledge or attitudes among users.	Telephone surveys/message survey replies	Postprogramme and annually
% of surveyed users who changed the targeted behaviour/s such as % of children up to age 18 years (or another age group) who brush their teeth twice daily with fluoride toothpaste	Outcome	It is best to have a baseline and also a post measure of engagement in specific behaviours targeted by the programme to see if behaviour change has occurred.	Telephone surveys/message survey replies	Annually
% of surveyed users who changed the targeted behaviour/s such as % of children who report eating sweets or soft drinks daily	Outcome	It is best to have a baseline and also a post measure of engagement in specific behaviours targeted by the programme to see if behaviour change has occurred.	Telephone surveys/message survey replies	Annually
% of surveyed users who reported an increase in their use of health services/got an oral health checkup	Outcome	It is best to have a baseline and also a post measure of engagement in specific behaviours targeted by the programme to see if behaviour change has occurred.	Telephone surveys/message survey replies	Annually
Programme performance – training	Outcome	This can be collected by health facilities as a basic question on an intake form or triage assessment form: for example, "Where did you hear about the service? What motivated you to come today?"	Health facility access or triage data	Annually

Indicator	Type	Comment	Data collection method	Frequency
Programme performance – training				
# of training units developed and available on the e-learning platform	Process	This indicates the content provided to target groups.	Progress report	M3 after launch and annually
Estimate of users engaging with content	Output	This indicates the number of users actively engaging with the content and possibly applying knowledge and skills offered through the training. Month three is specified as the first measure to identify if improvements need to be made.	Platform analytics	M3 after launch and annually
# of users who completed trainings	Output	This shows how many users remained in the course and completed all units offered.	Platform analytics	M3 after launch and annually
% of users who increased their quiz scores pre- and post-programme in knowledge quizzes (chatbots and apps)	Outcome	Training should include knowledge, attitudes or practice tests before and after providing training content.	Online or in-training surveys	Postprogramme and annually
% of primary health care facilities collecting and reporting data on oral diseases as part of a Health management Information System	Outcome	This indicates application of the module content in actual work context.	Surveys, referral rates, patient interviews	M3 after completion of training (survey), annually for other data
Programme performance – early detection				
# of completed trainings on early detection	Output	This shows how many users have completed trainings and can apply early detection technology.	Records of training and resource allocation	Annually
% of the users who completed trainings on early detection who are using the learning and techniques in their work	Outcome	This shows whether the learning and resources provided for early detection are being used in practice.	Surveys with health workers (or service managers) who were trained and provided with resources for early detection	M6 postlaunch and annually

Indicator	Type	Comment	Data collection method	Frequency
% of primary health care facilities able to provide safe oral urgent treatment % increase in a) treatment and b) referral rates	Outcome	This indicates if the early-detection activities are having an effect on service provision.	Surveys with service managers/ medical record data/facility records	M6 postlaunch and annually
Programme performance – surveillance				
# of people monitored	Output	Reach of surveillance	Platform database	Annually
Interventions (policy or clinical) developed based on surveillance data	Outcome	Indicates if data collected through surveillance activity have been used for decision-making and development of appropriate response/intervention/ policy	Health system	Annually
Programme promotion				
Promotion strategy compiled	Process	A promotion strategy is a plan laying out the promotion activities that will be completed and when.	Carried out: yes/no	Annually
# of media pieces	Input	This indicates the number of media pieces published in local and/or national newspapers and/ or broadcast on radio/TV.	Media analysis	Monthly
# of users who were made aware of the mHealth intervention by a given marketing channel	Output	This asks users how they heard about the programme	Survey through message channel, telephone survey or survey during consultations	Annually
User satisfaction with promotion campaign	Outcome	User satisfaction questions could include: • Were the promotion materials easy to understand? • Were they appropriate for you and your community? • Were you able to sign up with the information provided by the promotion campaign?	Survey	Annually

Indicator	Type	Comment	Data collection method	Frequency
% of surveyed health care workers who know about (or use) the programme	Output	This measures the reach of the programme to the average health worker/target audience member.	Survey	Annually
% of surveyed health care workers who encourage their patients to use the programme	Outcome	This indicator attempts to understand health care workers' engagement with the programme.	Survey	Biannually
Functionality and technology performance				
Functioning dashboard	Input	Is the platform dashboard functioning without service outages?	Yes/no	Annually
Ease of sign-up: Was it easy for users to subscribe on a scale of 1 to 5?	Output	Any barriers to sign-up or engagement may have a serious effect on the number of users. The process should be clear, easy and not too burdensome. This indicator can check this. If users say it was not easy, you may need to revisit the design of your sign-up or engagement procedure.	Message or telephone survey responses	User testing and first quarter
# of system errors	Output	A system error is an error in the operating system that may or may not impact the delivery of content.	Service analytics[a] and/or message or telephone survey responses	Quarterly
# days/weeks of system downtime	Output	This records any amount of time that content did not reach users due to a system error.	Service analytics	Monthly
# of bugs reported and fixed (apps)	Output	This is both a proxy for technology performance and a measure of responsiveness of the service provider.	Information from regular contact with technology provider	Monthly

a Service analytics are routinely collected back-end data from a platform that can be provided by the service operator (e.g., telecoms provider, chatbot provider).

Indicator	Type	Comment	Data collection method	Frequency
Reach and retention				
Demographic information about users	Output	This can help to assess what groups are accessing the programme and what target user groups may not be equitably accessing the programme.	Telephone surveys/message survey replies	Quarterly
# of dropouts (STOP replies in the case of messaging) or users who opted out	Outcome	This can be used as a proxy for user satisfaction.	Service analytics	Monthly
# of inputs received from users	Output	If a two-way messaging program or other two-way communication platform is being used, on average how many responses were received from participants? This could be reported as a percentage, with the total number of prompts for reply as the denominator for the percentage calculation ((replies/#prompts)x100).	Service analytics	Quarterly
Oral health system impact				
Incidence of oral diseases (e.g., tooth decay) in children aged X	Impact	This indicates if the programme has an impact on oral disease burden.	Oral health surveillance	Annually
# of treatments of an oral disease (e.g., tooth decay) in children aged X	Impact	This indicates impact on oral health care use.	Health system	Annually

Annex 6. Negotiating with telecommunications operators

Strategic partnerships can be mutually beneficial if they are a good fit with one or more organizations' long-term corporate strategies. Through consultation with private companies, BHBM has identified a number of factors that motivate the private sector to collaborate with country programmes, including shared missions and the opportunity to share knowledge and extend programme reach, among others. In addition, the private sector and particularly telecoms operators provide BHBM programmes with several opportunities to improve service delivery.

It is necessary to ensure that any partnership remains impartial and that the organization does not pose a conflict of interest. Any contracts or written agreements should be accompanied by a declaration of interests and a due diligence process with clear clauses regarding data ownership and intellectual property. To maximize chances of success, attempts should be made to select companies whose longer term engagement is consistent with their corporate strategy and core business. This will ensure a sustainable, long-term partnership. BHBM has some experience working with private partners and can provide advice and support with managing these potential partners.

Negotiating with telecoms operators will be key to the success of the programme because if any cost is incurred for end users or if they feel the programme is not secure or is tedious to use, it is likely that they will not engage with the programme. This is relevant whether you are running the programme via SMS or smartphone apps. In the case of SMS, there should be no fee to receive or reply to programme messages, and in the case of messenger apps, it will be necessary to waive data costs associated with receipt of and replies to messages. If you choose to build a standalone oral health app, the initial download must be free (both the price of the app and the data required for its download), and subsequent information exchange should also be free. In all cases, users' data should be private and secure.

The objectives of the negotiations are to:

- reduce or cut costs associated with the programmes, especially the costs that fall on the intended users of the programme
- make the programme hassle free for the end users
- ensure data protection and privacy of the end users.

Entering into discussions well prepared is essential. Here are some tips, gathered throughout the seven years of BHBM programming, for giving yourself a good chance of success:

- Ahead of negotiations, consultations need to be held with relevant authorities (e.g., the telecommunications authority, national ministries and market regulators) to identify and understand what benefits/privileges can be granted to telecoms operators in return for their collaboration. (For example, it could be discussed what visibility options could be offered to the operator to showcase its corporate social responsibility.)
- Have an ICT expert with technical knowledge of the platform and software you are using with you to respond to technical questions or discussions.
- Share your values and vision and discuss those of the telecoms company, highlighting where values match.
- ITU (regional office) can act as a bridge to facilitate the negotiations between the MoH, the telecommunications authority and telecoms companies.
- The intended number of users of the programme must be estimated before commencing negotiations with telecoms companies. This will help to assess the scale of contribution that telecoms need to be asked for.
- The negotiators must be aware of the current costs of services, costs of packages and sliding rates, which are vital for the negotiations.
- Incentivize the participation of telecoms companies.

To incentivize preferential rates and engagement, negotiators could leverage any combination of the following arguments:

- Direct benefits can be provided to the operators from the Ministry of Commerce (e.g., tax relief for gifted services).
- Increased policy and consumer confidence and a greater appetite for additional services may be an incentive.
- Operators have the added benefit of an access point into a new market by understanding the mHealth service structure and user experiences.
- Within the broader programme timeline, operators can use their growing experience to develop their independent mHealth portfolios, nationally or internationally, driven by rising national demand.
- Showing the effectiveness of mHealth services could offer operators a new source of future revenue in value-added health services.
- Given that in most countries the telecoms market consists of two to three major providers that have more or less similar subscription plans, a telecoms operator can distinguish itself from the rest of the market by demonstrating its ability to offer additional benefits to its users.
- An early-mover advantage is knowledge transfer: operators need to learn how to run large-scale public health programmes, and participation in the programme will maximize the quantity and quality of knowledge in comparison to the competition.
- From a public relations angle, showcase the company's contribution to the public well-being through marketing, providing good visibility as a socially responsible company. The MoH needs to ensure that they offer operators options for this visibility, including promotion in mobile stores, potentially with the MoH or programme logo, websites and public campaigns.
- Establish a good working relationship with the MoH (and possibly with the telecommunications authority).
- Operators need support for their own interests in mHealth: mobile money and mobile health insurance. Telecoms companies can identify priority areas where the MoH can consider providing support in the future.
- Operators will be favourably positioned for future innovations and experience (both nationally and internationally).
- There are also benefits to the employees of telecoms companies:
  - priority for employees when registering for the programme
  - morale boost
  - contribution to employee wellness, productivity and corporate health insurance.

BHBM is here to help with this, and its ITU secretariat members can accompany you in negotiations. Just write to bhbm@who.int for assistance.

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