Digital possibilities in the prevention and early detection of oral cancer in the WHO South-East Asia Region

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Abstract

Cancers of the lip and oral cavity are the most common cancers among men in the World Health Organization (WHO) South-East Asia Region. Most cancers of the oral cavity are attributable to tobacco smoking, smokeless tobacco use and areca-nut product use, alone or in combination, and excessive consumption of alcohol. These risk factors are highly prevalent in parts of the region. This paper outlines an integrated framework for oral cancer prevention, which includes a strengthened primary health-care workforce, enhanced community engagement and a positive policy environment. Operationalizing this framework could be greatly facilitated by the application of digital technologies. Robust evidence exists for the effectiveness of using appropriately trained primary health-care workers to screen for oral cancer by oral visual examination; this can be combined with counselling for risk-behaviour modification as part of an overall strategy on noncommunicable diseases. This needs to be supported by greater overall community engagement, for example to tackle low levels of awareness of the harmful effects of smokeless tobacco and areca-nut products. A strong policy environment that supports and promotes these efforts is essential, along with the enforcement of the measures required by the WHO Framework Convention on Tobacco Control. Despite the burden of disease, oral cancer has been a neglected area of public health. This paper considers how the positively disruptive effects of digital technology may enable much-needed acceleration in prevention and control efforts.

Keywords: areca nut, digital health, oral cancer, oral visual examination, tobacco, South-East Asia

Oral cancer in the WHO South-East Asia Region and current service delivery

The burden of cancers of the lip and oral cavity is high in the World Health Organization (WHO) South-East Asia Region. The Globocan data sets report that cancers of the lip and oral cavity were the fourth most common of the 2 003 789 new cancer cases in the region in 2018.¹ In men in the WHO South-East Asia Region, neoplasms of the lip and oral cavity have the highest incidence of all cancers.¹ The buccal mucosa is the most common site for oral cancer in south and south-east Asia.² More than 75% of oral cancers are attributed to use of tobacco, areca-nut products and alcohol, which are endemic risk behaviours in many parts of the region.³ Other risk factors include use of hookahs/waterpipes, consumption of nitrosamine-rich foods, infection with human papillomavirus, exposure to ultraviolet light and a diet low in fruits and non-starchy vegetables.³

In the region, most people with oral cancer present at advanced stages, which necessitates expensive and aggressive treatment and results in low cure rates. By contrast, the treatment for early-stage oral cancer is simple and effective, with survival rates exceeding 90% at 5 years.⁴

Visual screening of the oral cavity has been widely evaluated for its feasibility, safety, acceptability, accuracy in detecting oral potentially malignant lesions and oral cancer, and efficacy and cost-effectiveness in reducing oral cancer mortality. Visual screening involves systematic visual and physical examination of the intraoral mucosa under bright light, followed by inspection and digital palpation of the neck for any enlarged lymph nodes.⁵

In 2017, we investigated the current service delivery mechanisms in the region for early detection and prevention of oral cancer; the national focal points for the oral health services of Bhutan, Nepal and Sri Lanka completed an open-ended digital questionnaire. The responses, together with our knowledge of the situation in India, were categorized as positive factors, barriers and opportunities for improving oral cancer prevention, screening and early detection (see Box 1).

The Integrated Framework for Oral Cancer Prevention

This Integrated Framework for Oral Cancer Prevention in the WHO South-East Asia Region has been developed by the
Box 1. Situation analysis of oral cancer prevention, screening and early detection

Positive factors

- Training primary health-care workers in early detection and prevention of oral cancer has been incorporated into the national cancer control strategies in India and Sri Lanka.
- Isolated efforts are in place at the tertiary level of the health-care system in other countries.

Barriers

- There is a general lack of understanding of the harmfulness of the widely accepted and culturally endemic practice of smokeless tobacco use.
- Areca nut is cultivated in large areas of land in the region.
- The level of health-care workers’ awareness of the harm caused by areca-nut products is low.
- Enforcement of the measures required by the WHO Framework Convention on Tobacco Control (FCTC) to reduce the demand for tobacco is deficient.
- National cancer registries exist, but oral potentially malignant lesions are not notifiable and have therefore not been included to date.

Opportunities for action

- Educate the public on the dangers associated with the use of tobacco, areca-nut products and alcohol and on the early signs of oral cancer.
- Educate primary health-care workers on early detection of oral cancer and oral potentially malignant lesions.
- Improve reporting mechanisms and linkages to the treatment of oral cancer and oral potentially malignant lesions.
- Establish national registries on oral cancer and oral potentially malignant lesions.
- Enforce stringent implementation of the FCTC’s measures on the sale, availability and manufacture of tobacco.

Centre for Dental Education and Research, All India Institute of Medical Sciences, New Delhi, which is a WHO Collaborating Centre for Oral Health Promotion. The regional guidance on which the framework is based was put together in consultation with the WHO Regional Office for South-East Asia and built on the operational guidelines and implementation framework developed for the Government of India.7 This training module was developed for primary health-care workers on early detection and referral of suspected oral cancers as part of the WHO Package of essential noncommunicable disease interventions and healthy lifestyle interventions.8

As shown in Fig. 1, the framework comprises three independent but mutually reinforcing components: a strengthened primary health-care workforce; greater community engagement; and a positive policy environment. Operationalizing this framework will be greatly facilitated by the application of digital technologies. Digital technologies are rapidly changing the composition and delivery of health services. Introducing these technologies can be positively disruptive, in that it opens up new ways of delivering community-based services that are more suited to an era of rising noncommunicable diseases and ageing populations than the traditional hospital-based service model.9 Digital interventions to improve public health can be exploited for oral cancer screening and early detection, with the aim of reducing the burden of oral potentially malignant lesions and oral cancer. A number of web platforms and mobile health applications offer interventions for early detection and screening of oral cancer. These involve training and empowerment of health-care providers, machine learning to interpret images for diagnosis, the creation of digital hubs for screening, and patient education. The countries in the region are at different stages in relation to the various aspects of the framework and in terms of adopting digital solutions to improve the delivery of health services. This perspective paper briefly describes the framework and illustrates how digital technology might be used to amplify and accelerate results.

Strengthening the primary health-care workforce

All the countries in the region have cadres of health-care workers providing front-line services, including auxiliary nurse midwives, staff nurses, community health workers, lady health visitors and multipurpose workers. These primary health-care workers are ideally placed to implement risk reduction through behavioural interventions and to conduct visual oral examinations and teach oral self-examination. Their role may include the direct provision of behavioural interventions for tobacco use or harmful use of alcohol, or referral for such interventions. As the primary health contact point at household level, these health-care workers are best placed to coordinate, document and report on the care pathway for patients.

Evidence base

Research carried out over the past three decades has demonstrated the feasibility of using front-line health workers to screen for oral cancer. In a study in the 1980s in Sri Lanka, 34 primary health-care workers were trained to examine the mucosa of the oral cavity. In return for an incentive per case, they were asked to perform the examination on people aged 20 years and over as part of their routine work, which included house-to-house visits. In a year, the primary health-care workers examined almost 30,000 people and demonstrated a very satisfactory level of diagnostic accuracy. This study showed that use of primary health-care workers for the early detection of oral cancer and oral potentially malignant lesions was feasible and provided a valuable example of the community-based approach for early detection of oral cancer.10

A study in 1982–1983 in rural Kerala, India, found that incorporating an early oral cancer detection programme into the existing health-care infrastructure was feasible and beneficial. Basic health workers responsible for household visits to help control communicable diseases and implement family planning were trained to identify individuals at high risk for oral cancer, perform visual oral examinations and refer appropriately.11 A 10-year study in the same location involved a range of tobacco-cessation interventions delivered annually to individuals and small groups, including one-to-one...
counselling, a film, posters and messages broadcast on the local radio station. The educational interventions reduced both tobacco use and the incidence of oral potentially malignant disorders.\textsuperscript{13}

A large cluster randomized controlled trial in Kerala, India, involved trained health workers screening high-risk tobacco and alcohol users during home visits. Visual oral inspection was undertaken in bright daylight with the additional use of a flashlight. Screening was repeated every 3 years for a maximum of four cycles. The 15-year follow-up data showed a 38\% reduction in oral cancer incidence and an 81\% reduction in mortality in participants who complied with all the screening rounds.\textsuperscript{14}

Visual oral examination is therefore an established method of detecting oral potentially malignant disorders and early stages of oral cancer when delivered by trained caregivers. The sensitivity and specificity of visual oral examinations are moderately high. Based on the evidence, the recent report of an expert group recommended visual oral examination by well-trained auxiliary health workers combined with tobacco and alcohol reduction counselling as the primary screening strategy in India. The expert group noted that, because tobacco users are a high-risk group for noncommunicable diseases generally, this strategy offers an opportunity to address multiple noncommunicable diseases in the same setting. The expert group recommends that oral cancer screening should target adults aged 30–60 years in high-risk populations, with the aim of screening once every 3 years.\textsuperscript{15}

**Implementation strategies using digital solutions**

All the countries in the region are affected by epidemiological transition, characterized by a greater need for prevention and management of noncommunicable diseases. Therefore, the challenge is how to sensitize a front-line health workforce traditionally focused on maternal, child and communicable diseases to the requirements of the evolving disease burden, such as oral cancer screening and early detection.\textsuperscript{16} Training primary health-care workers in early detection and prevention of oral cancer has been incorporated into the national cancer control strategies of India and Sri Lanka. In India in 2016, for example, robust guidelines and capacity-building plans were developed. These were integrated into the population-based screening programme for noncommunicable diseases. Thus, as part of the strategic shift to comprehensive primary health care, oral cancer has been included in the screening and prevention programme for noncommunicable diseases, along with cervical cancer, breast cancer, and hypertension and diabetes.\textsuperscript{6} A framework has been developed to guide local implementation and capacity building at state and district levels.\textsuperscript{7} Sri Lanka has an integrated programme for cervical, breast and oral cancer,\textsuperscript{17} with mobile units for oral cancer screening.

Primary health-care workers may be engaged in behavioural interventions for cessation of use of tobacco, areca-nut products or alcohol, conducting visual oral examinations or teaching oral self-examination. All these tasks can be facilitated using digital technologies. For example, visual oral

\textbf{Fig. 1. The integrated framework for oral cancer prevention}
examinations can be accompanied by showing a video on self-
examination, oral hygiene and warning signs that should be
reported. Coordination, documentation and reporting are also
some of the tasks that the primary health-care care workers
take on to ensure continuity of service delivery. These can
be digitized using portable devices to monitor coverage,
problem areas, feedback and various other aspects of service
delivery. Portable devices such as tablets may also be used
for community education and for collecting data for monitoring
and evaluation of services.

The National Informatics Centre and Government of Tamil
Nadu have set up an innovative digital screening strategy that
has accelerated screening, diagnosis, follow-up and treatment
for oral cancer and oral potentially malignant lesions. A mobile
app developed by the National Informatics Centre was loaded
onto tablets that have been issued to every primary health-
care centre to be used by dental surgeons or assistants. The
app prompts the collection of registration details, provides
information on risk factors and symptoms, and allows images
of lesions to be captured. Cases are referred to higher-level
institutions as required. Follow-up and treatment are also
tracked by the app. Dental surgeons and assistants and other
health-care workers in the network can share and discuss
cases digitally.

India’s Ayushman Bharat comprehensive primary health-care
initiative is undertaking a population-based noncommunicable
diseases programme. This is a referral-based programme
where health workers screen all individuals aged 30 years and
over for hypertension, diabetes and oral, breast and cervical
cancers. At-risk individuals are progressively referred to
higher public facilities, diagnosed, treated and then managed
for life at the primary health-care level. In this programme,
community health workers will be issued with tablets with
preloaded screening algorithms designed to help in collecting
data, recording findings and making referrals. The portable
devices will also be used to monitor coverage, detect problems
and collect feedback. The digital link will enable faster and
uninterrupted communication between the primary and the
tertiary health-care levels.

Digital technologies have been essential for scaling up
to roll out population-based screening training, for which in-
person training is neither feasible nor economically viable.
To date, the Extension of Community Outcomes project has been
successful in India; in this hub-and-spokes model, experts (the
hub) provide a virtual training course for community health-
care workers (the spokes). Further efforts to harness digital
technology to link experts with front-line health workers also
show promise, and initiatives using Massive Open Online Courses and teleconsultations are in development.

The use of machine learning (also known as deep learning)
for medical image interpretation is an area of intense research
in many medical specialties. Research is under way in several
institutions to investigate the potential of this technique to
facilitate classification of oral lesions. The policy think tank
of the Government of India, NITI Aayog, is at an advanced
stage of launching a programme to develop a national digital
repository of annotated and curated cancer pathology images.
Another related project under discussion is an imaging biobank
for cancer, which would provide an unprecedented opportunity
for use of artificial intelligence to inform decision-making in
cancer treatment at low cost. Enhanced community engagement

The empowerment and engagement of communities will be
essential to reduce the burden of oral cancer in the region.
Information, education and communication strategies should
follow a life-course approach, whereby materials on risk
factors and early detection are targeted at different age
groups, including school children, adolescents, parents,
adults and older people. Digital media sent via text, voice
or multimedia messages have a powerful role to play in
reaching these different population segments. For example,
communication materials aimed at changing attitudes and
behaviours in relation to tobacco use can be tailored to
different populations. Through the Be he@lthy, be mobile
initiative, WHO and the International Telecommunication
Union promote noncommunicable disease prevention using
mobile technology. There is extensive evidence that mobile
phone-based support for smoking cessation is effective, and
the initiative provides guidance on the development and
deployment of national tobacco cessation programmes.

In India, the National Tobacco Control Programme and the
Ministry of Health and Family Welfare, with support from the
Be he@lthy, be mobile initiative, implemented a tobacco
cessation programme. Two-way mobile phone messaging
between the individual seeking to quit and programme
specialists provides dynamic support for those who wish to
quit. The government has recently released a second version
of the platform, which delivers the content through text
messages or interactive voice responses in 12 languages.
The programme’s progress is monitored in real time through
an online dashboard that records the number of registrations,
disaggregated by factors such as gender, geography and type
of tobacco use. To date, the programme has over 2.1 million
self-registered users. A Be he@lthy, be mobile handbook on
the use of mobile technology for oral health is in development.
Digital communications could also be deployed to break down
barriers to visiting health-care providers, explain the benefits
of early detection and remove the stigma about a diagnosis of
oral cancer.

Digital communications also have an important role to play
in addressing the urgent need to educate the public on the
dangers associated with tobacco, areca-nut products and
alcohol and on early signs of oral cancer. A particular focus
of health promotion campaigns should be tackling the lack of
understanding of the harsh realities of the harms associated
with using tobacco and areca-nut products.

Positive policy environment

A conducive policy environment is essential for health systems
to deliver the continuum of prevention, early detection and
treatment initiatives that must be implemented if reductions in
oral cancer morbidity and mortality are to be achieved. One
key policy requirement is empowering and deploying front-
line health workers to carry out screening. In addition, strong
policies to reduce preventable risk behaviours are essential.
These should be embedded within robust overall policies that
promote and facilitate healthy lifestyle choices.

Tackling the tobacco epidemic is an urgent priority, since
one in four smokers globally and more than 80% of the world’s
smokeless tobacco users reside in the WHO South-East Asia
Region. In 2008, WHO introduced a package of six evidence-
based tobacco control demand reduction measures that have
been proven to reduce tobacco use and assist countries in fulfilling their obligations under the WHO Framework Convention on Tobacco Control (FCTC). These measures, known as the MPOWER package, reflect one or more provisions of the framework: M, monitoring tobacco use and treatment; P, protecting people from tobacco smoke; O, offering help to quit tobacco use; W, warning about the dangers of tobacco; E, enforcing bans on tobacco advertising, promotion, and sponsorship; and R, raising taxes on tobacco. Countries in the WHO South-East Asia Region have achieved various levels of success in implementing the FCTC and the MPOWER package, but many challenges remain. These include the continued relative affordability of tobacco products, despite tax and price rises; use of multiple and diverse tobacco products; high use of smokeless tobacco; interference by the tobacco industry; the introduction of new tobacco products; and the accessibility of these products to young people. The PRACTICAL guidance for policy-makers was launched in 2017 to further accelerate the implementation of the WHO FCTC throughout the region. As noted by the guidance, the tobacco industry is using the internet and social media to market its products in a powerful way. It is therefore worth considering how digital solutions can be exploited to support the policy measures recommended by the PRACTICAL guidance. For example, campaigns can help to generate public support for various tobacco control policies, such as smoke-free legislation and tobacco cessation, so social media and other digital platforms could be used strategically to counteract the tobacco industry’s narrative.

Anticipated roadblocks and ways forward

Controlling oral cancer requires prevention measures that are focused on tobacco, areca-nut products and alcohol use and on early detection at the primary health-care level. Without organized prevention and early detection and treatment efforts, oral cancer will continue to be a dominant public health problem across the region. Efforts need to be made to improve the currently low levels of advocacy for visual oral examination and early detection efforts for the prevention of oral cancer. While programmes on maternal and child health and communicable diseases may continue to be the focus at the primary-care level, priorities are shifting towards noncommunicable diseases, and oral cancer must be included in policy planning. A key concept to communicate is the lead time gained through early detection of oral potentially malignant lesions and oral cancer. Equally important is the need to tackle tobacco and areca-nut product use among primary health-care workers, which detracts from health promotion activities.

Nevertheless, progress is being made in some parts of the region; this may serve as a model for others to adopt and adapt to their local circumstances. Such adaptations should consider the positively disruptive effects that digital technology may have for the much-needed acceleration of efforts to prevent and control oral cancer.

Source of support: None.

Conflict of interest: None declared.

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