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Co-development of the educational content of a proposed educational mobile health application prototype on oral cancer using Delphi technique

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Health literacy plays a vital role in improving literacy on oral cancer. Currently, the use of mobile health applications (MHAs) to educate oral cancer is largely underutilised. So far, only two educational MHAs on oral cancer ("M-OncoED" and "Prayaas") have ever been reported in peer-reviewed empirical studies, and these two MHAs lacked a comprehensive and inclusive content for laypersons. Hence, this present study aimed to co-develop a comprehensive and inclusive educational content for an educational MHA prototype on oral cancer using Delphi technique. This Delphi study was four-phased, and a total of sixty subject matter experts (SMEs) participated in the study. The phases of this study included the literature review phase (first phase) and three rounds of expert consultations (the second to the fourth phases). Consensus was achieved when a mean Likert score of 3 or above was obtained from the responding SMEs. The SMEs were dental, medical, and public health experts recruited from eight countries across four continents. A total of sixty, fifty-seven, and nineteen experts participated in the first, second, and third rounds of the Delphi consultations, respectively, reviewing an eight-sectioned educational content on oral cancer which was initially developed through literature review. Based on the feedback obtained from the Delphi consultations, the working educational content on oral cancer were iteratively revised till a final content was developed. This study produced a comprehensive and inclusive educational content which can be used to develop an educational MHA on oral cancer for laypersons.

Keywords Delphi technique, Health education, MHealth, Oral cancer

Oral cancer, which refers to a malignant neoplasia affecting the lips, oral cavity (mouth), and/or the oropharynx (throat), ranks as the most common cancer type in the head and neck region, the 16th most common cancer worldwide, and the 15th cause of deaths in the world[1,2]. According to the World Health Organization[3], over 377,000 people have oral cancers as at the year 2020. Unfortunately, less than 60% of people diagnosed with oral cancer survive five years after being diagnosed with the disease[4–6]. Also, the costs of treatment of oral cancer are very expensive, and many families, especially those in the lower- and middle-income countries where there is insufficient health insurance coverage for cancer care, have been impoverished due to these high costs[7–9].

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The risk factors of oral cancer are numerous; however, the major ones are tobacco use, alcohol use, and human papillomavirus infection—all of these major risk factors are preventable through healthy lifestyles[10,11].

Health literacy plays a vital role in improving public awareness and knowledge on oral cancer[12,13]. Health literacy refers to the set of skills an individual possesses to understand, process, access, and use health-related information to keep a healthy life[12,13]. Therefore, through health literacy education on oral cancer, people's understanding of oral cancer and its prevention and treatment can be improved to boost their health-related behaviours and decision-making processes concerning oral cancer[13].

Over the years, the public have used diverse sources of information to acquire health literacy on oral cancer, and they include both digital and non-digital sources[14–16]. The digital sources include mHealth, websites, television, and social media while non-digital outlets include word-of-mouth from health professionals, family and friends, newspaper, and flyers[14–16]. The use of digital sources of information on oral cancer is gaining grounds in this present century, due to the recent technological advancements in information technology[16]. Also, billions of people across the world have access to digital devices, including mobile phones, making people have easier access to oral cancer-related information within their reach and convenience[17].

Research has shown that people who have mobile phones are better informed about their health compared to those who lack mobile phones[17]. However, the use of mhealth interventions (such as the use of wearable or portable monitoring devices, the use of mobile phone-based short messaging service, and the use of mobile health applications[18] to educate the public about oral cancer is still largely underutilised. In the evidence available in peer-reviewed literature, only two mhealth interventions are known so far—M-OncoED and Prayaas—and both were mobile health applications[19–21]. Pertinently, one of these applications (M-OncoED) was designed to educate physicians while the other (Prayaas) was for the education of laypersons; also, the one for laypersons lacked robust educative information on oral cancer and it was focused on the Indian population[19–21]. This therefore demonstrates the need to develop and create a more comprehensive and a more inclusive educative mhealth intervention on oral cancer that can be used by laypersons from different parts of the world.

The development and creation of a comprehensive and inclusive mhealth intervention is a complex and systematic process[22]. According to the PRODUCES (PRoblem, Objective, Design, (end-) Users, Co-creators, Evaluation, Scalability) framework[22], such process should have three stages, and it should involve the active engagement of relevant stakeholders through participatory action research approach. The first stage of the process involves the co-development of the content of the proposed intervention, the second stage should involve its co-creation, and the third stage involves its testing[22]. There are different participatory action research approaches that can be used in each of these stages, and common approaches include the use of Delphi technique, the Deliberate Democracy Forum technique, and the Boot Camp Translation technique[23,24]. Of all these research approaches, the Delphi technique is the oldest and the most widely used technique[23–26].

Aim of the study

Currently, there is a lack of a comprehensive and inclusive educative mhealth intervention that can be used to educate laypersons about oral cancer. To solve this problem, this present study (which forms a part of a major research project that seeks to co-develop, co-create, and test an educative mobile health application prototype on oral cancer[27] aimed to co-develop a comprehensive and inclusive educational content for a proposed educative mobile health application prototype on oral cancer using Delphi technique.

Methods
Study design

This study adopted a Delphi study design, and it was conducted and reported in accordance with the Guidance on Conducting and REporting DElphi Studies (CREDES) framework[28]. This Delphi study comprised four phases. The first phase involved the development of an oral cancer educational content through literature review while the second, third, and fourth phases involved expert consultations on the developed educational content (Fig. 1).
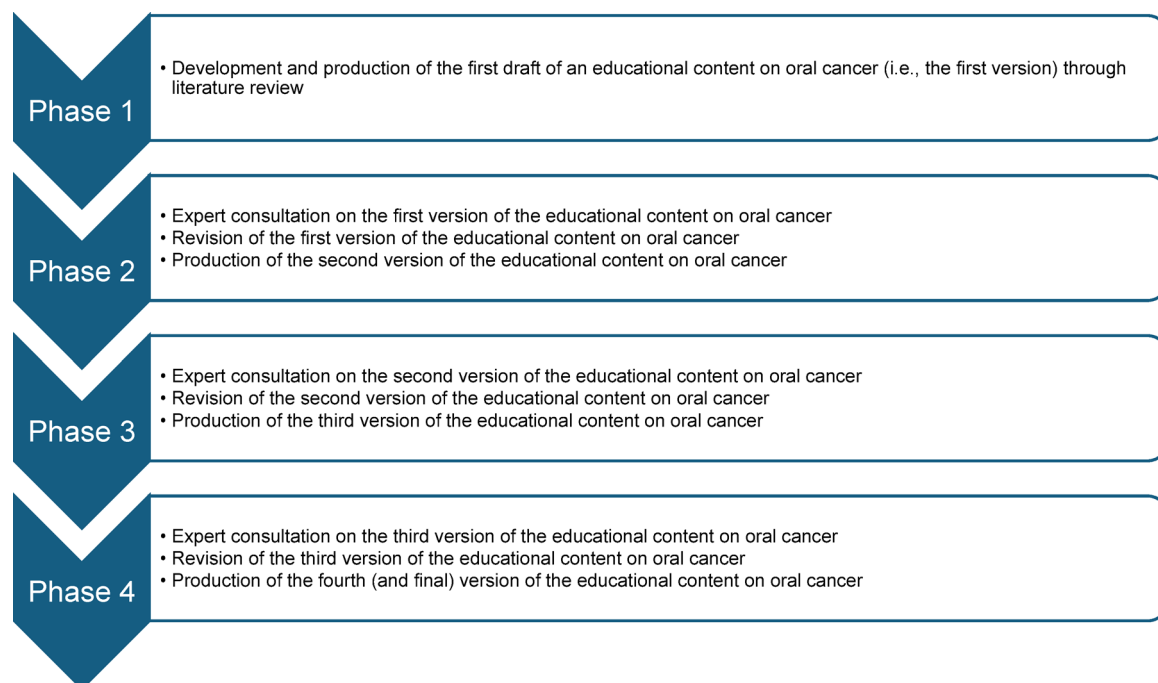
Scientific committee

It is crucial to have a scientific committee who oversee the conduct of a Delphi study[28]. The scientific committee are experts in the research topic area, and they play a crucial role in ensuring the study is conducted with rigour[26,28]. In this study, the authors played the role of the study's scientific committee[26]. This study's scientific committee consists of two dental public health scientists/practitioners (KKK, AAS, LAN), one oral pathologist (AOA), one oral and maxillofacial surgeon (RDJ), and one biomedical scientist in oral oncology (YAJ). The scientific committee members were chosen based on their academic portfolio, expertise, and experience in oral cancer research, practice, and advocacy (all members have at least three years of experience in oral cancer research, practice, or advocacy, and they have published extensively on oral cancer). None of the scientific committee members was a participant in this study.

Subject matter experts

The subject matter experts engaged in this study were individuals who met the following eligibility criteria:

1. Have at least one academic/specialist qualification in oral and maxillofacial surgery, oral medicine, oral pathology, dental public health, public health, general medicine, and general dentistry.
2. Have at least two years of experience in their area of specialization.
3. Are willing to participate in the Delphi study.

A sample size of sixty subject matter experts was considered sufficient for this study, as this sample size is well above the average range of sample size (6 to 50) for most Delphi studies[25,26].

Fig. 1. The flow of the phases of the Delphi study.

These subject members were recruited through two international oral cancer research organisations which has memberships across different continents (including Africa, Asia, Europe, and North America). These organisations are namely: (i) Consortium for Head and Neck Cancer in Africa (formerly called the International Head and Neck Cancer Working Group)[29], and (ii) the Asia-Pacific Oral Cancer Network[30].

The scientific committee of this study contacted one executive in each these two organisations requesting them to invite eligible experts in their networks to participate in this study. Only those experts that met all the eligibility criteria were engaged in this study as subject matter experts.

Study instruments

Two study instruments were used in this Delphi study, and both were semi-structured questionnaire. The first instrument (Supplementary file 1) was used in the second phase of this study, and it obtained the following information from the subject matter experts:

i.   Sociodemographic characteristics (including country location, age, gender, area of specialisation, and years of practice in specialisation area).
ii. Grading of the relevance the content of each section in the educational content using a Likert scale of 1 to 4 (1 – Not relevant; 2 – Somewhat relevant; 3 – Quite relevant; 4 – Highly relevant).
iii. Comments on each section of the shared educational content.

The second instrument (Supplementary file 2) was used in the third phase of this study, and it obtained the following information from the subject matter experts:

i. Grading of their satisfaction on the content of each section in the revised educational content using a Likert scale of 1 to 4 (1 – Very dissatisfied; 2 – Dissatisfied; 3 – Satisfied; 4 – Very satisfied).
ii. Comments on each section of the shared educational content.

The second instrument did not obtain information on the sociodemographic characteristics of the subject matter experts engaged in the third phase because only those that participated in the first round of expert consultation (i.e. Phase 2 of this study) was invited to participate in this study phase.

Phase 1: development of the first version of the educational content

This study phase involved the development and production of the first version of an educational content on oral cancer through literature review. The literature used to develop this educational content was obtained through searches of selected databases (PubMed, SCOPUS, ScienceDirect, and Google Scholar) and websites of selected national and international health organisations (including World Health Organization (WHO), National Health Service [UK], Centers for Disease Control and Prevention, American Cancer Society, National Center for Chronic Disease Prevention and Health Promotion, and Cancer Research UK). The literature used for the content development were recent reviews, published between 2013 and 2024, and were obtained using multiple combinations of the following search terms: 'oral cancer', 'oral squamous cell carcinoma', 'epidemiology', 'burden',

'risk factors', 'clinical features', 'symptoms', 'signs', 'diagnosis', 'treatment', 'management', 'prognosis', 'support', and 'organisation'. From the search, the most informative, recent, and relevant literature were chosen and used to develop the content. Furthermore, in the content development process, the recommendations for developing an informative, educational and communication materials for laypersons, by Thorseth[31], were adopted as a guide, since the target population for the content are lay populations.

Phases 2–4: expert consultation on the educational content

Phases 2 to 4 of this study involved consulting the participating subject matter experts to obtain their feedback on the education content. All consultation processes were done via email correspondence.

Phase 2

This study phase (Phase 2) was the first round of consultation on the first version of the educational content. In this phase, sixty consenting subject matter experts were sent the first version of the educational content and a questionnaire (Supplementary file 1) to obtain qualitative and quantitative feedback concerning the relevance and quality of each section of the educational content. Based on the feedback, the first version of educational content was revised, producing the second version.

Phase 3

This study phase (Phase 3) was the second round of consultation on the second version of the educational content. In this phase, only those subject matter experts that participated in Phase 2 of this study were invited. They were sent the second version of the educational content together with a questionnaire (Supplementary file 2) and a document containing the feedback on the rebuttal and actions taken by the scientific committee concerning each comment provided by the subject matter experts in the first round of Delphi consultation and were asked to review the new version of the content and provide their feedback on their level of satisfaction and additional comments, if any, concerning the revisions made, using the questionnaire provided. Based on the feedback obtained, the second version of educational content was revised, producing the third version.

Phase 4

This study phase (Phase 4) was the third round of consultation on the third version of the educational content. In this study phase, only those subject matter experts that provided additional comments (i.e. qualitative comments) were contacted. These experts were sent the third version of the educational content, and a document containing the feedback on the rebuttal and actions taken by the scientific committee concerning each comment they have provided in the previous study phase (Phase 3). In this phase, one or more cycles of email correspondence was done between the subject matter experts and the scientific committee, and all subject matter experts contacted finally agreed with the actions/rebuttal of the scientific committee. Based on the inputs obtained from the subject matter experts, the third version of the educational content was revised to produce the fourth version of the content.

Data analysis

Both quantitative and qualitative data were obtained in this Delphi study. However, only the quantitative data were analysed. The qualitative data obtained were review comments on the educational content. In line with the study objectives, the qualitative data obtained do not require data analysis; however, they were used to inform the rounds of revisions done on the educational content that is under development.

The Statistical Package for Social Sciences (SPSS) version 28 software was used for the quantitative data analysis. In line with the study objectives, only descriptive statistics were done to determine the frequency distribution of all variables, and patterns of some selected variables using measures of central tendency (mean, mode, and median) and dispersion (range, and standard deviation).

Definition of consensus

Consensus was determined using the mean of the responses obtained via Likert scales in the first and second rounds of expert consultations. The Likert scale used in the first round obtained feedback on the level of relevance of each section of the educational content while the one used in the second round obtained feedback on the level of satisfaction of the subject matter experts.

Consensus was considered to be achieved for each section of the educational content only when a mean Likert score of 3 or above was obtained from the responding subject matter experts during the first round of Delphi consultation, and this established the content validity of each section of the content. Furthermore, only those sections with a mean score of 3 or above were retained in the educational content[32].

Ethical considerations

This study was done in strict compliance with the 1964 Helsinki Declaration on health research involving human subjects. Ethical clearance to conduct this study was approved by the School of Health and Life Science Research Sub-Committee of Teesside University (Ref: 2024 Mar 20233 Kanmodi). Participation in this study was completely voluntary and confidential.

Results
Sociodemographic characteristics

Roughly half (51.7%) of the sixty subject matter experts that participated in this Delphi study were located in Sri Lanka. The mean (± SD) age of the experts was 42.20 (± 9.352) years, and all were within the age range of 26 to 60 years. Majority (68.3%) of them were males, 21.7% each specialised in general dentistry and (dental) public

Characteristics	Frequency/Value	Percentage
Gender		
Male	41	68.3
Female	19	31.7
Age (in years)		
Mean	42.20	N/A
Standard deviation	9.352	N/A
Range	26–60	N/A
Country Location (Continent)		
Sri Lanka (Asia)	31	51.7
Nigeria (Africa)	17	28.3
India (Asia)	4	6.7
UK (Europe)	3	5.0
Rwanda (Africa)	2	3.3
Malaysia (Asia)	1	1.7
USA (North America)	1	1.7
South Africa (Africa)	1	1.7
Area of Specialisation		
Dental public health / public health	13	21.7
General dentistry	13	21.7
Oral and maxillofacial surgery	12	20.0
Oral pathology	8	13.3
General medicine	8	13.3
Oral medicine	6	10.0
Years of practice in the current area of specialisation		
Mean	10.72	N/A
Standard deviation	6.936	N/A
Range	2–30	N/A

Table 1. Sociodemographic characteristics of the subject matter experts. N/A – Not applicable

No.	Section Tag	Content
1	Section A	This section provided lay information on the meaning and epidemiology of oral cancer
2	Section B	This section provided lay information on the risk factors of oral cancer
3	Section C	This section provided lay information on the clinical features of oral cancer
4	Section D	This section provided lay information on how oral cancer can be prevented
5	Section E	This section provided lay information on how oral cancer is diagnosed
6	Section F	This section provided lay information on how oral cancer is treated
7	Section G	This section provided lay information on organisations that provide oral cancer-related support services
8	Section H	This section listed the sources where the information used to develop Sections A to G were obtained

Table 2. The sections of the educational content on oral cancer.

health. All of them have been practicing in their areas of specialisation for an average of 10.72 (SD = 6.936) years (Table 1).

Outcomes of phase 1 of the Delphi study

In this phase of this Delphi study, the first version of the educational content on oral cancer was developed (Supplementary file 3) after extensive review of literature obtained from multiple sources. This educational content has eight sections which are listed in Table 2.

Outcomes of phase 2 of the Delphi study

This phase of the Delphi study involved the first round of Delphi consultation on the first version of the educational content on oral cancer. A total of 60 subject matter experts participated in the Delphi consultation. Table 3 depicts the frequencies, mean, mode, median, and range of their ratings on the relevance of each section of the first version of the educational content (Supplementary file 3). Based on the mean rating scores (≥ 3.46 [Table 3]), all the sections in the first version of the educational content were rated to be relevant sections of the content; hence, all sections were retained. However, 41 experts gave written comments (qualitative feedback [Supplementary file

Section of the educational content	N	Quantitative assessment of the level of relevance of each section of the educational content								
		Not relevant (%)	Somewhat relevant (%)	Quite relevant (%)	Highly relevant (%)	Mean	Median	Mode	SD	Range
Section A: What is Oral Cancer?	60	0 (0.0)	1 (1.7)	12 (20.0)	47 (78.3)	3.77	4.00	4	0.465	2–4
Section B: What are the Risk Factors of Oral Cancer?	59	0 (0.0)	0 (0.0)	8 (13.6)	51 (86.4)	3.86	4.00	4	0.345	3–4
Section C: What are the Symptoms of Oral Cancer?	59	0 (0.0)	1 (1.7)	7 (11.9)	51 (86.4)	3.85	4.00	4	0.407	2–4
Section D: How can Oral Cancer be Prevented?	60	0 (0.0)	1 (1.7)	6 (10.0)	53 (88.3)	3.87	4.00	4	0.389	2–4
Section E: How is Oral Cancer Diagnosed?	59	0 (0.0)	2 (3.4)	22 (37.3)	35 (59.3)	3.56	4.00	4	0.565	2–4
Section F: How is Oral Cancer Treated?	59	0 (0.0)	5 (8.5)	16 (27.1)	38 (64.4)	3.56	4.00	4	0.650	2–4
Section G: Do you need Support for Oral Cancer?	60	0 (0.0)	2 (3.3)	15 (25.0)	43 (71.7)	3.68	4.00	4	0.537	2–4
Section H: Our Sources of Information	59	1 (1.7)	5 (8.5)	19 (32.2)	34 (57.6)	3.46	4.00	4	0.727	1–4

Table 3. Analysis of quantitative feedback obtained in the first round of the Delphi study from the subject matter experts. N – Total number of respondents per category; SD – Standard deviation

Section of the educational content	N	Quantitative assessment of the level of relevance of each section of the educational content								
		Very dissatisfied (%)	Dissatisfied (%)	Satisfied (%)	Very satisfied (%)	Mean	Median	Mode	SD	Range
Section A: What is Oral Cancer?	57	0 (0.0)	1 (1.8)	25 (43.9)	31 (54.4)	3.53	4.00	4	0.538	1–4
Section B: What are the Risk Factors of Oral Cancer?	57	0 (0.0)	1 (1.8)	25 (43.9)	31 (54.4)	3.53	4.00	4	0.538	1–4
Section C: What are the Symptoms of Oral Cancer?	57	0 (0.0)	1 (1.8)	22 (38.6)	34 (59.6)	3.58	4.00	4	0.533	1–4
Section D: How can Oral Cancer be Prevented?	57	0 (0.0)	1 (1.8)	19 (33.3)	37 (64.9)	3.63	4.00	4	0.522	1–4
Section E: How is Oral Cancer Diagnosed?	57	0 (0.0)	1 (1.8)	22 (38.6)	34 (59.6)	3.58	4.00	4	0.533	1–4
Section F: How is Oral Cancer Treated?	57	0 (0.0)	0 (0.0)	27 (47.4)	30 (52.6)	3.53	4.00	4	0.504	3–4
Section G: Do you need Support for Oral Cancer?	57	0 (0.0)	0 (0.0)	24 (42.1)	33 (57.9)	3.58	4.00	4	0.498	3–4
Section H: Our Sources of Information	56	0 (0.0)	0 (0.0)	22 (39.3)	34 (60.7)	3.61	4.00	4	0.493	3–4

Table 4. Analysis of quantitative feedback obtained in the second round of the Delphi study from the subject matter experts. N – Total number of respondents per category; SD – Standard deviation

5]) concerning the first version of the educational content. Out of these 41 experts, only 13, 21, 21, 10, 13, 13, 5, and 4 of them provided comments on sections A, B, C, D, E, F, G, and H respectively concerning the first version. Based on these comments, the second version of the educational content (Supplementary file 4) together with written documentation on the rebuttal and actions taken by the scientific committee concerning these provided comments (Supplementary file 5) were produced in this study phase.

Outcomes of phase 3 of the Delphi study
This phase of the Delphi study involved the second round of Delphi consultation, during which the participants were provided with the revised version (i.e. the second version) of the educational content on oral cancer as well as the written documentation on the rebuttal and actions taken by the scientific committee (Supplementary files 4 & 5). A total of 57 subject matter experts (95% of those that participated in the first round of Delphi consultation) participated in the second round of the Delphi consultation. Table 4 depicts the frequencies, mean, mode, median, and range of their ratings on their satisfaction concerning each section of the second version of the educational content. Based on these mean rating scores (≥ 3.53 [Table 4]), all the sections in the second version of the educational content were rated to have been satisfactorily revised. However, only 19 out of these 57 experts gave written comments (qualitative feedback) (Supplementary file 7) concerning the second version of the educational content. Out of these 19 experts, only 8, 17, 6, 2, 5, 8, and 1 of them provided comments on sections A, B, C, D, E, F, and G, respectively, while and none (0) provided any comment concerning the second version of the educational content. Based on the comments obtained, the third version of the educational content on oral cancer (Supplementary file 6) together with a written documentation on the rebuttal and actions taken by the scientific committee concerning these comments were produced in this study phase (Supplementary file 7).

Outcomes of phase 4 of the Delphi study
This phase of the Delphi study involved the third round of Delphi consultation, during which the participants were provided with the third version of the educational content on oral cancer as well as the written documentation on the rebuttal and actions taken by the scientific committee (Supplementary files 6 & 7). Notably, this round only seeks to follow-up on those comments raised in the previous round (i.e. the second round) of Delphi consultation; hence, only those experts that provided comments in the second round of Delphi consultation ($n=19$) were contacted in this round. In this round of Delphi consultation, one or more cycles of email exchanges between the scientific committee and each of these 19 experts occurred till all these experts have no new comment or concern concerning the third version of the educational content. Specifically, 18 out of those

19 experts that participated in this round finally agreed with the scientific committee after one cycle of email exchange while only one expert finally agreed after the second cycle of email exchange.

The final version of the educational content

Four versions of educational content on oral cancer were developed in this study. The first version is Supplementary file 3, the second version is Supplementary file 4, the third version is Supplementary file 6, and the fourth (and final) version is Supplementary file 8.

Discussion

The authors of this study, through rigorous consultations with a team of subject matter experts, has co-developed a comprehensive and inclusive educational content on oral cancer through Delphi technique. Delphi technique is a rigorous participatory action research approach that has been extensively used in the literature for the development of diverse contents including academic curricula[33–35], frameworks[36–38], and guidelines[39–41]. Contents that were developed using Delphi technique has been lauded to be robust and of superior quality, and of universal utility[42,43]. Considering the rigour of Delphi technique over other participatory action research approaches, coupled with current global scepticism about the credibility and the reliability of digital health-related information that are available on the internet[16,44], it can be asserted that the systematic engagement of subject matter experts in the co-development of educational contents is very crucial in educational interventions targeting the public[22–24].

The prevention and care of oral cancer is multidisciplinary in nature, and it involves the contributions of experts from diverse specialisation areas[45]. This justifies the engagement of experts from six specialty areas related to diverse aspects of oral cancer prevention (oral cancer education, screening, etc.) and care (chemotherapy, radiotherapy, surgery, etc.) as the subject matter experts in the Delphi consultations (Table 1). Through these engagements, robust and in-depth feedback concerning the clinical and public health aspects of the educational content on oral cancer were obtained from the consulted experts (Supplementary files 5 and 7). Based on the experts' feedback (Tables 3 and 4; Supplementary files 5 and 7), series of in-depth and robust revisions were done on the educational content, and this availed the scientific committee the opportunity to produce a robust educational content on oral cancer that could serve a broader population of end-users.

Also, to enable the development of a comprehensive and inclusive educational content on oral cancer, the scientific committee ensured that subject matter experts from different countries across the world were consulted. These experts were based in eight countries across four continents (Africa, Asia, Europe, and North America) (Table 1). Furthermore, the country location of these experts were countries with low-income (Rwanda), low-middle (Nigeria, Sri Lanka, and India), upper-middle (Malaysia and South Africa), and high-income economies (United States and United Kingdom) economies[46], making the participation diverse, rich, and inclusive. Coincidentally, virtually all the countries where the participating experts were located and practicing had one of the highest burdens (including new cases and deaths) of oral cancer in the world[47–50]; this, therefore, provide deep insights into their level of in-depth knowledge on pertinent clinical and public health issues concerning oral cancer prevention and care. Also, this provides the opportunity for the content to be able to serve a pool of end-users across different level of socio-economic strata.

Notably, the sample of subject matter experts recruited into this study is relatively large, compared to several other Delphi studies involving subject matter experts. Most Delphi studies adopted the use of very small sample sizes, ranging between eight and twenty experts[33–35,51]. The essence of the use of a relatively larger sample in this Delphi consultation was to obtain comprehensive evaluation of the content, and to ensure that the content is inclusive, as the use of smaller sample size may minimise such opportunity[52].

Comparing the final version of the educational content on oral cancer that was developed in this present study (Supplementary file 8) with those pre-existing educational contents available on the internet, it can be asserted that the educational content developed in this study is much more robust and current than other known educational contents on oral cancer that are available on the internet. For example, the educational content on oral cancer by the National Health Service (NHS) of the United Kingdom lacked information on sources that the readers could consult for further reading or support on oral cancer; also, NHS's educational content did not holistically capture all the subtypes of oral cancer in its information[53]. Another notable example is the educational content of the Centers for Disease Control and Prevention (CDC) on oral cancer which provided a very scanty information on the disease; also, the description of the anatomical site of oral cancer in the CDC's educational content was not comprehensive (the content did not list lip as one of the anatomical sites affected by oral cancer)[2,54].

With this newly developed educational content, the authors aim to use it to co-create a more comprehensive and inclusive mobile health application that can be used to improve public awareness and knowledge on oral cancer. This mobile health application will first be co-created as a prototype, with inputs from digital communication experts and oral cancer-at-risk persons, after which it will be tested through a randomised control trial, as recommended in the PRODUCES framework[22,27,55].

This study has its limitation. This study aimed to develop a comprehensive and inclusive educational content on oral cancer through a Delphi process. This study did not obtain inputs from lay populations and minority populations due to the need to ensure the accuracy of the content as it is believed that accurate information on oral cancer is best obtained from experts in oral cancer research, prevention, and care. To cater for this limitation, the authors ensured that there is a broad country and specialty representation on the panel of subject matter experts.

Notwithstanding this limitation, this study has its strength. To the best of the authors' knowledge, this study is believed to be the first empirical study to adopt Delphi technique in the co-development of an information, education, and communication (IEC) material. The robustness and the detailed documentation of the

methodology of this study, using the CREDES framework, makes this study reproducible, lending insights to researchers who may aim to co-develop IEC material in future.

In conclusion, this study has co-developed a comprehensive and inclusive educational content on oral cancer through a systematic and rigorous scientific approach. The co-developed educational content will form an essential ingredient needed for the development of an educative mobile health application on oral cancer.

Data availability

The data that support the findings of this study are available from the authors, but restrictions apply to the availability of these data, and they are not publicly available. Data are, however, available from the authors upon reasonable request.

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Declarations

Competing interests

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Ethics statement

This study was done in strict compliance with the 1964 Helsinki Declaration on health research involving

human subjects. Ethical clearance to conduct this study was obtained from the School of Health and Life Science Research Sub-Committee of Teesside University (Ref: 2024 Mar 20233 Kanmodi). Participation in this study was completely voluntary and confidential.

Consent to participate

Written informed consent was obtained from the participants to publish this report in accordance with the journal's patient consent policy.

Additional information

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