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TECNOLOGIAS EM SAÚDE COMO SUPORTE PARA APRENDIZAGEM E DIAGNÓSTICO EM ESTOMATOLOGIA

Porto Alegre
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Tese apresentada como requisito parcial à obtenção do título de Doutor em Clínica Odontológica - Área de concentração em Estomatologia do Programa de Pós-graduação em Odontologia da Universidade Federal do Rio Grande do Sul.

Orientador: Prof. Dr. Pantelis Varvaki Rados.
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DEDICATÓRIA

À minha família, que representa para mim todo amor que houver nessa vida, é a minha força, meus maiores incentivadores, e não mediram esforços para que eu conseguisse mais uma vez sair da minha cidade em busca de um sonho.

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RESUMO

A rede mundial de computadores tem sido cada vez mais utilizada para difundir conteúdo. Na perspectiva da educação em saúde, o YouTube™, uma das plataformas on-line mais utilizadas, pode ser uma valiosa ferramenta para complementar a formação de estudantes, favorecer a educação permanente entre profissionais e a conscientização do público leigo. Nesse sentido, o TelessaúdeRS-UFRGS, um projeto da Universidade Federal do Rio Grande do Sul tem como um dos seus principais eixos a difusão de conhecimento e oferecimento de apoio clínico a profissionais de saúde que atuam longe dos grandes centros. Em função disso, tem utilizado a plataforma YouTube™ para disseminar conhecimento. O objetivo deste estudo foi analisar a visibilidade, popularidade dos vídeos relacionados a temas odontológicos publicados pelo TelessaúdeRS-UFRGS. Para isso, foram selecionados os vídeos sobre diferentes temas vinculados à odontologia. Posteriormente, a relação entre duração do vídeo e percentual de visualização foi analisada por meio de testes específicos. Foram encontrados 32 vídeos sobre temas de odontologia. Em relação ao perfil, a maioria dos espectadores era do sexo feminino (73,0%) e pertencia à faixa etária de 18 a 24 anos (45,1%). O número médio de visualizações de vídeo foi de 9,414 (intervalo: 158–102,700). A duração média dos vídeos foi de 5,6 min, variando de 0,3 a 10,1 min. A taxa média de visualização foi de 522,3, variando de 1,8 a 6381,2. Em termos de popularidade, a média de ‘’likes’’ foi de 196 (intervalo: 0–1800) e *“dislikes”,* 5 (intervalo: 0–56). Vídeos mais curtos apresentaram maior visibilidade, enquanto vídeos mais longos tiveram melhor desempenho em termos de interação. A alta visibilidade dos vídeos demonstra que um canal do Youtube™ tem potencial para atingir um grande número de pessoas. Deve-se reconhecer que a duração do vídeo é fundamental para atingir o objetivo em termos de visibilidade e popularidade. Essa estratégia deve ser utilizada regularmente por universidades e instâncias governamentais para disseminar conteúdo de alta qualidade. Nesse sentido, ferramentas tecnológicas tem sido cada vez mais objeto de estudo, especialmente direcionadas como apoio ao diagnóstico e educação permanente na estomatologia. Nesse contexto, buscamos identificar através de uma revisão narrativa da literatura, as principais ferramentas tecnológicas utilizadas como apoio à estomatologia. Para tal finalidade, foram realizadas buscas em três bases de dados (PubMed, SciELO e SCOPUS). Descrições das características das ferramentas de suporte foram as principais medidas de resultado. O protocolo do Instituto Joanna Briggs foi usado para avaliar o risco de viés dos estudos. Esta revisão identificou 135 publicações, das quais 41 atenderam aos critérios de inclusão. A maioria dos artigos foram realizados na Índia e publicados em revistas de tecnologia em saúde. A maior parte das evidências sobre o uso de tecnologia de suporte em estomatologia envolveu o uso de aplicativos móveis, plataformas baseadas em nuvem e mídias sociais. A maioria dos estudos foram descritivos, sendo 26 (63,41%) classificados como baixo risco de viés. As ferramentas tecnológicas utilizadas para apoiar à estomatologia parecem ter potencial para contribuir com a prática clínica e promover a educação permanente dos profissionais de saúde.

Palavras-chave: Educação em saúde; Educação à distância; Odontologia; Medicina bucal; Rede social; Internet; YouTube; Saúde digital, Aplicativos de saúde, Telessaúde.

ABSTRACT

The worldwide web has been increasingly used to broadcast content. From the perspective of health education, YouTube™, one of the most used online platforms, can be a valuable tool to complement student dental training, promote continuing education among professionals and raise awareness among the lay public. In this sense, TelessaúdeRS-UFRGS, a project of the Federal University of Rio Grande do Sul, has as one of its main objectives the dissemination of knowledge and offering clinical support to health professionals who work far from specialized centers. As a result, it has used the YouTube™ platform to disseminate knowledge. The present study aimed to analyze the visibility and popularity of videos related to dental topics published by TelessaúdeRS-UFRGS. For this, videos on different topics related to dentistry were selected. Subsequently, the relationship between video duration and viewing percentage was analyzed using specific tests. 32 videos on dentistry topics were found. Regarding the profile, most viewers were female (73.0%) and belonged to the age group from 18 to 24 years (45.1%). The average number of video views was 9,414 (range: 158–102,700). The average duration of the videos was 5.6 min, ranging from 0.3 to 10.1 min. The average view rate was 522.3, ranging from 1.8 to 6381.2. In terms of popularity, the average “likes” was 196 (range: 0–1800) and “dislikes” was 5 (range: 0–56). Shorter videos showed higher visibility, while longer videos performed better in terms of interaction. The high visibility of the videos demonstrates that a Youtube™ channel has the potential to reach many people. It should be recognized that the length of the video is critical to achieving the goal in terms of visibility and popularity. This strategy should be used regularly by universities and government bodies to disseminate high-quality content. In this sense, technological tools have been increasingly the object of study, especially related to supporting diagnosis and continuing education in oral medicine. In this context, we seek to identify, through a narrative review of the literature, the main technological tools used to support oral medicine. For this purpose, searches were performed in three databases (PubMed, SciELO, and SCOPUS). Descriptions of the characteristics and usability of the support tools were the main outcome measures. The Joanna Briggs Institute protocol was used to assess the risk of bias in the studies. This review identified 135 publications, of which 41 met the inclusion criteria. Most of the articles were conducted in India and published in health technology journals. Most of the evidence on the use of assistive technology in oral medicine involved the use of mobile apps, cloud-based platforms, and social media. Most studies were descriptive, with 26 (63.41%) classified as low risk of bias. The technological tools used to support oral medicine seem to have the potential to contribute to clinical practice and promote the continuing education of health professionals.

Keywords: education health; Distance education; Dentistry; Oral medicine; Social Networking; Internet; Youtube™; Digital health; Health apps, Telehealth.

SUMÁRIO

1 ANTECEDENTES E JUSTIFICATIVA

A integração de novas tecnologias nas formas de transmissão de informação e comunicação baseadas na internet estão sendo amplamente disponibilizadas para estudantes, educadores e população em geral de várias maneiras (HOLLINDERBÄUMER; HARTZ; UCKERT, 2013). Diferente da mídia tradicional, a nova geração, conhecida por Web 2.0, permite ao usuário selecionar o conteúdo e participar de ativamente da rede (SILVA et al., 2016). Essa incorporação dos meios eletrônicos teve um impacto significativo na educação, especialmente devido ao aumento das plataformas de *e-learning* ou de aprendizagem on-line (SADEGHI; HESHMATI, 2019; SEO et al., 2018). Atualmente, esses recursos estão sendo cada vez mais utilizados no ensino em muitas universidades. Através da rede mundial de computadores, plataformas de acesso aberto, como o YouTube™, têm despertado bastante interesse. Outros fatores, como personalização do ritmo de acesso aos conteúdos, possibilidade de autogerenciamento do tempo (SEO et al., 2018) parecem estar fortemente relacionados a esse processo (SADEGHI; HESHMATI, 2019).

As organizações de saúde, sociedades científicas, revistas profissionais, e pacientes buscam nas redes sociais (YouTube™, Twitter, Facebook) uma forma para divulgar ou receber informações. Dentre essas mídias, destaca-se o YouTube™, um site da internet fundado em fevereiro de 2005 que oferece a oportunidade de compartilhamento de vídeos, favorecendo a comunicação e a troca de ideias de forma virtual (KATA, 2012). Nessa plataforma, encontra-se mais de 60% de todo o conteúdo de vídeo disponível na Internet, contando com mais de 100 milhões de vídeos que excedem 2 bilhões de visualizações ao dia. O YouTube™ é um dos sites mais frequentados em todo o mundo e mostra uma capacidade de difusão que pode afetar significativamente o campo da educação em saúde (TUELLS et al., 2015). Em odontologia, um estudo que avaliou a influência do *e-learning* na percepção dos alunos de pós-graduação demonstrou que dos 124 entrevistados (48,6%), preferiram a aula tradicional associada com o aprendizado on-line, enquanto 46 alunos (18%) preferiram apenas o estilo tradicional. Os principais meios eletrônicos utilizados e que os alunos consideraram ter o maior impacto no aprendizado, foram: YouTube™ e o Google. Além disso, *e-learning* teve um efeito significativo (escores de 4/5) na

compreensão didática (65,1%) e no entendimento clínico (71,4%). Dessa forma, os autores recomendam esse método de ensino para melhorar a percepção dos alunos na teoria e posteriormente nas práticas clínicas (TURKYILMAZ et al., 2019).

A plataforma apresenta inúmeras vantagens, oportunizando educação permanente para profissionais, atuando na promoção de saúde e disponibilizando acesso a informação para pacientes (LÓPEZ-JORNET et al., 2017; NIEDEREPPE et al., 2007; PONS-FUSTER et al., 2020). Em tese, parece ser uma plataforma com potencial para disseminar informações de saúde oportuna (FAT et al., 2011). Adicionalmente, fornece uma nova abordagem, promove debates entre colegas, estimula o pensamento crítico e facilita a conexão entre teoria e prática (DIAS DA SILVA; PEREIRA; WALMSLEY, 2019; DUNCAN; YARWOOD-ROSS; HAIGH, 2013; KNÖSEL; JUNG; BLECKMANN, 2011). No estudo conduzido por Li et al. (2015) foi possível demonstrar essa conexão, uma vez que, 97,5% dos alunos de cursos como medicina, odontologia e enfermagem aprenderam os procedimentos clínicos através da internet. As plataformas mais utilizadas, o YouTube™ (93,2%) e/ou Google (77,7%), e na maioria das vezes, os alunos compartilharam o conteúdo com os colegas. Por outro lado, apenas 13% conversaram com os seus professores, o que também necessita de atenção, considerando que muitas informações acessadas podem não ser confiáveis.

O aumento expressivo do uso do YouTube™ foi atribuído à criação de um sistema social e digital de comunidade de pessoas interessadas em tópicos diversos e informação qualificada. Na odontologia, publicações recentes têm analisado o acesso a vídeos publicados no YouTube™ sobre câncer bucal, cuidados bucais em pacientes submetidos a transplante de órgãos e de células-tronco hematopoiéticas, síndrome da ardência bucal, implantes dentários, e leucoplasia bucal (FORTUNA et al., 2019; HASSONA et al., 2016; KOVALSKI et al., 2019; LÓPEZ-JORNET et al., 2017; PASSOS et al., 2020). Um achado em comum nesses estudos, é a que a maior parte do conteúdo disponibilizado através dos vídeos, não são cientificamente confiáveis (DIAS DA SILVA & WALMSLEY, 2019). Portanto, torna-se essencial que as Instituições de saúde e profissionais direcionem esforços para melhoria da informação eletrônica no YouTube™ ou em outras plataformas. Adicionalmente, uma pesquisa recentemente publicada por Dias Da Silva et al. (2019) buscou avaliar a

confiabilidade do conteúdo de educação odontológica encontrado no YouTube™. O estudo selecionou 40 vídeos sobre conteúdos diversificados, que receberam 25 milhões de visualizações e apresentaram uma duração média de 9,22 minutos. Um achado interessante indicou que apenas 5% do conteúdo era oferecido pelas universidades. Ou seja, a maior parte do conteúdo encontrado é produzido por editores não inseridos no contexto acadêmico e não corresponde aos critérios de confiabilidade. Curiosamente, a maioria dos usuários preferiu os vídeos longos ($p < 0,05$), e o índice de interação foi melhor para os vídeos mais antigos ($p < 0,01$). No entanto, os vídeos curtos tiveram maior índice de retenção dos usuários (70%). Dessa forma, quanto mais tempo o vídeo apresenta, maior a sua taxa de visualização e índices de interação, contudo, o índice de retenção foi menor. Diante desses resultados, a duração do conteúdo e os vídeos mais recentes influenciarão a retenção e a aprendizagem dos alunos.

Especificamente, a estomatologia, área da odontologia responsável pela prevenção, diagnóstico e tratamento das doenças da cavidade bucal ou das manifestações bucais de doenças sistêmicas também tem se beneficiado com o avanço das tecnologias (BIRUR et al., 2018; STREY et al., 2021). Estudos demonstram que os cirurgiões-dentistas não se sentem treinados para identificar lesões bucais e alguns profissionais costumam negligenciar o relato dessas lesões durante as consultas clínicas (APELIAN et al., 2020; STREY et al., 2021). Apesar disso, a literatura demonstra uma prevalência relativamente alta de lesões bucais na população geral em diferentes países (LÓPEZ JORNET, et al., 2007). A dificuldade no diagnóstico e manejo das lesões bucais tem levado a uma busca por ferramentas digitais que melhorem o conhecimento dos cirurgiões-dentistas sobre essas lesões (RAVAZI et al., 2013; BIRUR et al., 2018). Diante desse panorama associado a pandemia pelo Novo Coronavírus, houve uma maior visualização da necessidade de implementar métodos de ensino on-line bem, de atendimento remoto e tecnologias digitais móveis para saúde bucal (GIUDICE et al., 2020; YÜCE et al., 2021).

A área médica também tem investigado o alcance dessas mídias. Um estudo buscou analisar vídeos sobre exames físicos publicados em espanhol no YouTube™, considerando que o inglês é responsável pela maioria do conteúdo disponibilizado nas plataformas (RAMOS-RINCÓN et al., 2017). Dos quatros vídeos analisados, foram

avaliados o número total de visualizações (164.403 visualizações), o tempo de exibição (425.888 minutos) e a duração média da visualização dos quatro vídeos estudados (2:56 minutos). Uruguai, Equador, México e Porto Rico tiveram o maior número de visualizações por 100.000 habitantes, sendo o México o local de reprodução mais frequente, e os homens foram os que mais visualizaram os vídeos (variação de 51% a 77%). Dessa forma, os autores reconheceram que tutoriais em espanhol são uma ferramenta alternativa para ensinar habilidades de exame físico a alunos cuja primeira língua não é o inglês. Nesse contexto, no estudo de Silva et al. (2016) no qual avaliaram a visibilidade e cobertura dos vídeos relacionados a educação em saúde da atenção primária do canal do TelessaúdeRS, os resultados identificaram que o tempo total de exibição dos 45 vídeos selecionados foi de 244 minutos de duração. Os dez vídeos que atingiram a maioria das visualizações (59%) resumiram 64 minutos (26,22%), e o restante (73,78%), o que parece indicar, segundo os autores, que os vídeos de menor duração têm maior número de visualizações.

Além dessas utilizações, o uso dessas mídias pelas organizações de saúde parece desempenhar um papel de extrema importância, permitindo aprimoramento profissional, a promoção e o auxílio no processo de educação em saúde com a disponibilização de conteúdo de qualidade e confiável. Nesse contexto, o TelessaúdeRS é um projeto vinculado a Universidade Federal do Rio Grande do Sul (TELESSAÚDERS- UFRGS) criado em 2007 com o objetivo de propor soluções sistêmicas ao problema de fragmentação da rede de serviços do Sistema Único de Saúde. A Teleducação, um dos seus principais eixos, é um núcleo a partir do qual, palestras, entrevistas e cursos são planejados e oferecidos, sendo o YouTube™ a principal forma utilizada para divulgação destes conteúdos. Um estudo prévio mostrou aceitação favorável dessa plataforma por parte de enfermeiros e médicos, com visualização dos vídeos acontecendo no Brasil (98%) e em países como Portugal, Bolívia, EUA, México, Peru, Angola, entre outros (HARZHEIM et al., 2016; SILVA et al., 2016).

Contudo, a avaliação do uso destas plataformas de compartilhamento on-line, através da análise de visibilidade e difusão, bem como do público que mais utiliza esses recursos, são essenciais no planejamento dos vídeos a serem produzidos a fim de melhorar o potencial dessa ferramenta na difusão do conhecimento. Além disso,

não está claro qual é o perfil dos usuários que acessa os vídeos, se a duração vídeos interfere na manutenção dos usuários até o final da sua reprodução e se existem temas de maior interesse. Essas medidas são interessantes para demonstrar se o recurso tem potencial para educação em saúde ou se tem apenas o apelo de não necessitar de grandes investimentos. Porém, a maior parte dos estudos abordando a visibilidade das plataformas on-line de compartilhamento, como o YouTube™, são direcionadas a temas da medicina, e os estudos relacionados a odontologia ainda são pouco explorados.

Diante desse cenário, a acessibilidade de maneira quase universal das mídias digitais, a facilidade no uso para quem compartilha e para o público que visualiza, bem como o poder na difusão de informações e no processo de educação permanente, são fatores que devem ser considerados para a ampliação de pesquisas nessa temática dentro da odontologia e especificamente da estomatologia.

2 OBJETIVOS

2.1 OBJETIVO GERAL

Analisar o desempenho de vídeos relacionados a temas odontológicos publicados pelo TelessaúdeRS-UFRGS no seu canal na plataforma YouTube™ do ponto de vista da sua popularidade e identificar as ferramentas digitais disponíveis usadas para apoiar estomatologia por meio de uma revisão narrativa com busca sistemática.

2.2 OBJETIVOS ESPECÍFICOS

- Descrever o perfil do público que acessa os vídeos, a visibilidade e a popularidade dos vídeos;
- Verificar se o tempo de duração dos vídeos tem influência na sua visibilidade, na sua popularidade e na retenção do usuário até o final da sua reprodução;
- Descrever a origem de tráfego dos vídeos, os locais onde eles foram visualizados e a sua capacidade de indução de cadastramentos no canal do TelessaúdeRS-UFRGS.
- Revisar a literatura sobre as principais tecnologias digitais utilizadas como apoio à estomatologia.

3 ARTIGO CIENTÍFICO 1

Analysis of the visibility and popularity of Youtube™ videos about dentistry topics published by a Brazilian healthcare organization (TelessaúdeRS-UFRGS)

A ser submetido para o periódico Clinical Oral Investigations

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declarations

Ethics approval: This study was approved by the Institutional Review Board of the Federal University of Rio Grande do Sul (CAAE case number: 34572920.2.0000.5327; 4.167.713).

Consent to participate

For this type of study, formal consent is not required.

Conflicts of interest/Competing interests: The authors declare no potential conflicts of interest.

Abstract

Youtube™ is the second most popular website worldwide and is an important educational resource for health professionals and dental students. **Objectives:** This study aimed to evaluate the visibility, popularity, and dissemination of videos related to dental topics published by TelessaúdeRS-UFRGS, a non-profit organization that proposes interventions supported by high quality information to improve the function of the public health network. **Materials and Methods:** Videos about dentistry topics were retrieved from the Youtube™ channel of TelessaúdeRS-UFRGS. Information such as user profile, video duration, views, likes/dislikes ratio, and traffic source was obtained by means of the Youtube™ analytics tool. Based on those data, the viewing rate and interaction index were calculated to determine the visibility and popularity, respectively. **Results:** A total of 32 videos about dentistry topics were found. Regarding the profile, most viewers were female (73.0%) and belonged to the 18 to 24 years age group (45.1%). Regarding visibility, the videos had a wide range of views from 159 to 102,700. The same variability was observed regarding the viewing rate, user retention, and interaction index. Shorter videos (≤ 39 min) had a higher visibility, whereas longer videos (> 39 min) had a higher interaction index ($p < 0.01$, Mann-Whitney). **Conclusions:** The high visibility of the videos demonstrates that a Youtube™ channel has the potential to reach a large number of people. It must be recognized that the video duration is critical to achieve high visibility and popularity. This strategy should be regularly used by universities and governments to disseminate high quality content to students, professionals, and the general population.

Clinical relevance: Youtube™ videos can be a useful resource for health education both to bridge the knowledge gap and to promote continuing education actions.

Keywords: Youtube™; internet; health; media; video; patient; education.

1. INTRODUCTION

The integration of new technologies in internet-based forms of information transmission and communication is being made widely available to students, educators, and the general population in various ways [1,2]. This incorporation of electronic media has had a significant impact on education, especially due to the increase in e-learning or online learning platforms [3,4].

Among these media, Youtube™, an online video-sharing platform, concentrates more than 60% of all video content available on the internet, with more than 100 million videos that exceed 2 billion views per day [5]. The literature indicates numerous advantages of Youtube™, including the provision of continuing education for health workers and access to information for patients [6,7]. Factors such as customizing content access time and the possibility of self-management of time [4] seem to be strongly related to this process [3]. In theory, it appears to be a platform with the potential to disseminate timely health information [8].

Studies have demonstrated an information spreading dissemination capacity that can significantly affect the field of health education, including providing knowledge of infection control measures during periods of outbreak including the COVID-19 pandemic [5,8,9]. Therefore, healthcare organizations, scientific societies, professional journals, and patients have searched social networks (Youtube™, Twitter, Facebook) to disseminate or receive information.

TelessaúdeRS-UFRGS is a project launched in 2007 by means of a partnership between the Brazilian Ministry of Health and the Federal University of Rio Grande do Sul to create solutions for improving the quality of care offered in the Unified Health System. The tele-education team, one of its branches, offers lectures, interviews, and courses using Youtube™ as the main platform of dissemination, accounting for more than 5,200 subscribers and almost 600 videos. A previous study showed favorable acceptance of this platform by nurses and physicians, with videos shown in Brazil (98%) and in countries such as Portugal, Bolivia, USA, Mexico, Peru, Angola, among others [10]. Despite this, because the videos available on social media, mainly on Youtube™, are not monitored, the quality of their educational information may be questionable, especially in the fake news era. Taking these assumptions into account,

healthcare and educational organizations, as well as official institutions, should play a leading role in the production of content to assure their quality and reliability [2].

The almost universal accessibility of this platform, the ease of use, their potential for dissemination of information, and the continuing education process are factors that should be considered for the expansion of research about the topic. Furthermore, it is not clear what is the profile of users who access the videos, whether their duration interferes with the maintenance of users during reproduction, and which topics are more appealing. In the same way, there are no studies assessing whether videos produced by professionals or universities are attractive to the audience. Therefore, the purpose of this study is to analyze the visibility and popularity of Youtube™ videos related to dentistry published by TelessaúdeRS-UFRGS and discuss the usefulness of this platform for the dissemination of knowledge.

2. MATERIALS AND METHODS

Ethical considerations and study design

The study protocol was approved by the Local Research and Ethics Committee (process number CAAE: 34572920.2.0000.5327; 4.167.713). This analytical cross-sectional observational study evaluated the videos related to dentistry on the Youtube™ channel of TelessaúdeRS-UFRGS (www.youtube.com).

Selection of videos

The convenience sample of the present study comprised videos published from January 2012 to October 2019. These videos were selected by a manual search on the Youtube™ channel of TelessaúdeRS-UFRG focusing on the topics related to dentistry (https://www.youtube.com/TelessaudeRS). After a preliminary search, the videos pertaining to distance education courses at TelessaúdeRS-UFRGS and duplicate videos were excluded.

Analysis of the videos

The analysis of the videos was based on the Youtube™ "Analytics" tool and comprised: (a) the runtime; (b) upload date, (c) display time; (d) average viewing duration; (e) subscribers: number of users who subscribed to the channel after watching the video; (f) most accessed places; (g) information about the viewers; i.e., variables such as age group and sex were collected. The interaction of the users with the videos was also evaluated by means of the interaction index and viewing rate, which were calculated as follows [11].

- Viewing rate = total amount of views/ number of months since upload x 100%. The quality was not evaluated.
- Interaction index = (number of likes – number of dislikes)/total number of views x 100%.

Statistical analysis

The median duration was used as cutoff points to evaluate the influence of these variables on the popularity and visibility of the videos. Variables were tested for normality using the Kolmogorov-Smirnov test. The Kruskal-Wallis test was used to assess the influence of the source and duration of videos on the visibility and popularity. The interaction index was classified based on the quartiles as very low (< 1.50), low (1.51 to 3.8), high (3.9 to 4.6), or very high (> 4.70). To evaluate the influence of the video duration on its visibility and popularity, the videos were dichotomized based on the video duration median (cutoff point = 6 min) as follows: short (≤ 39 min) and long (> 39 min). The Spearman's test was used to assess the correlation between the viewing index and the channel subscribers. The analysis was performed using SPSS 22.0 (IBM, New York, NY, USA) and R software (Studio 1.4.1106) programs. The statistical significance level was set at $p < 0.05$.

3. RESULTS

A total of 32 videos about dentistry topics were found on the TelessaúdeRS-UFRGS channel. Their subjects covered different dentistry specialties such as oral

medicine, pedodontics, periodontology, radiology, public health dentistry, dental traumatology, patients with special needs, and temporomandibular joint disfunction. Most videos focused on oral medicine topics, such as oral cancer diagnosis, oral ulcerative lesions, oral erosive lesions, actinic cheilitis, burning mouth disease, management of patients under bisphosphonates use, and dental treatment of oral cancer patients.

Audience profile

According to the Youtube™ analytics tool, the audience was less than 34 years old. The majority of the viewers were female, accounting for 73.0%. This information is summarized in Table 1.

Table 1. Profile of the audience who accessed the videos about dentistry topics on the TelessaúdeRS-UFRGS Youtube™ channel.

Variable	Percentage
Age group	
18-24 years	45.1
25-34 years	31.4
35-44 years	23.5
Gender	
Male	27.0
Female	73.0

Visibility and popularity of the videos

Together, the videos accounted for 301,241 views, totaling more than 25,974 h. The performance of the videos in terms of visibility and popularity is presented in Table 2. The viewing percentage, which is the average duration in the video over the video time, averaged 23.7%. The video “Is possible to perform dental treatment during the

pregnancy?" had the highest viewing percentage (74.8%). In contrast, the video "Prevention, diagnosis and treatment of periodontal disease: Latin America consensus" had the lowest user retention (8.9%). On average, the duration of the videos was 37 min. The mean duration of views was 5.6 min, whereas the mean number of views was 9.414. When analyzing the traffic source of the videos, 33.7% were from external sources, whereas 32.9% were from Youtube™ searches. The suggested videos had a percentage of 30.8%. Other sources accounted for 2.6%.

Table 2. Evaluation of videos according to visibility and popularity.

Variables	Mean (SD)	Median	Min-Max
Visibility parameters			
Number of views	9.414 (19,726)	2.108	159-102,700
Viewing rate	502.2 (896.9)	196.1	7.6-4935.1
Video duration (min)	37.8 (23.4)	39.7	0.4-85.1
Viewing duration (min)	5.6 (2.7)	6.0	0.3-10.1
Viewer retention	23.7 (27.6)	16.6	9.9-74.8
Popularity parameters			
Likes	196 (345)	78	4-1,800
Dislikes	5 (11)	1	0-56
Comments	8 (17)	4	0-92
Interaction index	3.4	3.8	0.9-9.1
Subscribed	77 (160)	19	1-820

Regarding user interaction, the average likes corresponded to 196. The video "Not every burning sensation in the mouth is burning mouth syndrome?" had the highest number of reactions. This video generated 1,800 likes (average of all videos =

196), 56 dislikes (average = 5), and 92 comments (average = 8). This video also encouraged the highest number of new subscribers, totaling 820 users (average = 77). All videos were accessed from Brazil. Information about the top 10 videos according to the viewing rate is depicted in Table 3. Of the 32 dentistry videos published on the channel, most had high and very high interaction rates (25% in each category). A total of 28.1% had a very low interaction rate, and 21.9% had a low interaction rate. Detailed information of all published videos is provided in the Supplementary material.

Table 3. Visibility and popularity of the top 10 videos according to the viewing rate.

Title		Video duration	Views (n)	Percentage viewed	Viewing rate	Like/Dislike	Interaction index
1º	Not every burning sensation in the mouth is burning mouth syndrome	05:43	102,700	47.3	4,935.13	1,800/56	Low (1.70)
2º	Radiographic interpretation	37:09	39,292	19.5	1,646.77	617/12	Low (1.54)
3º	Oral health in the primary health care	36:18	37,309	15.7	1,367.63	374/29	Very low (0.92)
4º	Emergencies in Endodontics	30:14	24,531	22.7	1,012.42	360/19	Very low (1.39)
5º	Dental management of patients under bisphosphonates use	12:15	17,320	49.2	833.49	822/8	Very high (4.70)
6º	Not every mouth ulcer is a cold sore	14:07	12,224	34.6	651.25	297/5	Low (2.39)
7º	Oral cancer: dental approach	56:57	7,321	16.4	619.90	310/4	High (4.18)
8º	Role of allied dental professional on the detection of oral mucosal lesions	51:10	4,937	19.7	579.46	228/0	High (4.62)
9º	Diagnosis of oral cancer in the primary health care	42:22	11,724	16.8	484.46	108/5	Very low (0.88)
10º	Oral manifestations of sexually transmitted diseases	63:26	2,700	9.0	436.89	2/3	Low (3,30)

Influence of video duration on viewing rate, viewer retention, and interaction index

Short videos presented a higher user retention (22.7%) than long videos (12.3%) ($p < 0.01$, Mann Whitney) (Figure 1). Regarding the interaction, long videos scored better, showing an interaction index of 4.5, whereas short videos had an index of 1.7 ($p < 0.01$, Mann Whitney). A strong correlation was observed between the viewing rate and number of new subscribers of the Youtube™ channel (Spearman's test, $R = 0.98$, $p < 0.05$).

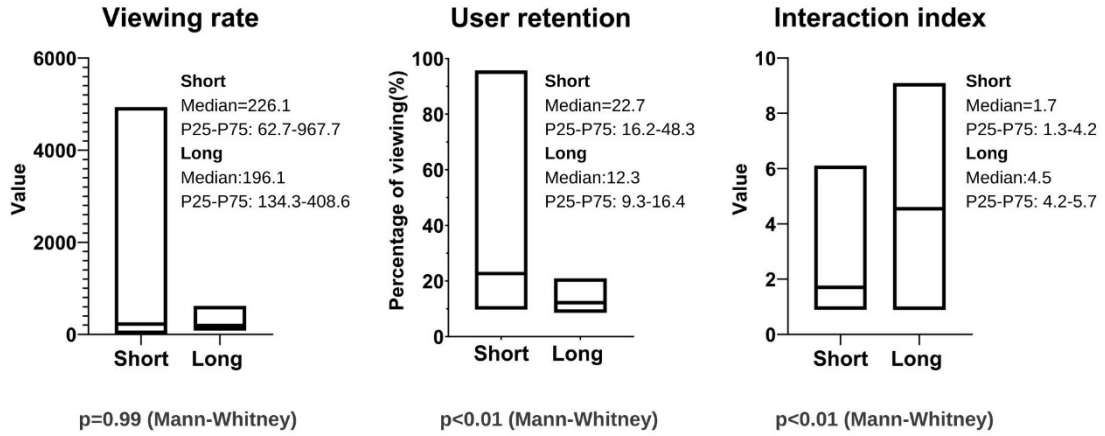

Figure 1. Evaluation of the association between video duration and viewing rate, user retention, and interaction index.

4. DISCUSSION

This remarkable increase in the use of Youtube™ was attributed to the creation of a social network, gathering people interested in a variety of topics and qualified information. In dentistry, recent publications have analyzed the access to videos published on Youtube™ on oral cancer, oral care in patients undergoing organ and hematopoietic stem cell transplantation, burning mouth syndrome, dental implants, and oral leukoplakia [6, 11-14]. A common finding in these studies is that most of the content made available through videos is not scientifically reliable. Therefore, it is essential that healthcare institutions and professionals put in effort to improve the electronic information on Youtube™ or other platforms. Corroborating this observation, recent research has shown that universities provided only 5% of the dental educational content found online [15].

In other words, most of the content found is produced by editors outside the academic context and does not meet the reliability criteria.

To the best of our knowledge, this is the first study to evaluate the performance of Youtube™ videos produced by a health organization with educational purposes. A remarkable finding was that shorter dentistry videos scored better in terms of user retention. However, longer videos generally had a better performance in terms of interaction, probably due to the possibility of exploring the content more deeply. In addition, the popularity of the videos from TelessaúdeRS-UFRGS, a recognized health institution due to its commitment to disseminating information supported by high quality scientific evidence, demonstrates its potential to promote knowledge.

The use of Youtube™ may have a positive impact on professional and public education. This statement is supported by the millions of views reached by its videos in the Ebola outbreak in 2014 [8]. The high number of views observed for the videos evaluated in the present study reinforces the potential of social media for disseminating information. Furthermore, it represents an alternative for continuing education for health professional and maybe to increase awareness of the population.

In dentistry, a study evaluating the influence of e-learning on the perception of graduate students showed that 48.6% of them appreciated the traditional class associated with online learning, whereas 18% preferred only the traditional style. The main electronic media used were Youtube™ and Google, which had the greatest impact on learning according to the students. In addition, e-learning had a significant effect (scores 4 of 5) on teaching comprehension (65.1%) and clinical understanding (71.4%). Thus, the authors recommend the use of those digital media as a teaching method to improve the students' perception in theory and later in clinical practice [16].

In the present study, it was demonstrated that video length is a critical factor to reach user retention and preference. Although the videos are of good quality and reliable, not all users will watch the videos in their entirety. As seen in a previous study related to videos about health education in the primary care from the TelessaúdeRS-UFRGS, users preferred short videos [10]. In contrast, Silva

et al. (2019) [15] found that users preferred longer videos. Another factor to consider is the interaction index. Longer videos are more suitable to address more complex subjects. This may be the reason for the higher interaction videos. Even when recognizing that the duration is important in the planning of videos, variables such as the subject appeal, different cut-off points to classify the videos as short or long, and different audiences make direct comparisons difficult.

Recently, Ozdede & Peker (2020) [17] analyzed the videos available on Youtube™ related to dentistry and the novel coronavirus (COVID-19). As expected, videos from official institutions had high level content and technical quality. These findings reinforce the importance and benefits of the content produced by experts, universities, and other recognized institutions. However, some studies have shown that low quality videos performed better in terms of visibility and popularity. It is likely that this finding results from poor communication due to the use of an excessively technical or complex language by experts, an aspect that should be considered when producing videos [18,19].

This study has some limitations. Although some information about the audience may be obtained using the Youtube™ analytics, it is not possible to know if the viewers are health professionals or are from a lay audience. Obviously, that factor may influence the preference for the videos and the capacity to follow the video content. Regardless of that, it is important to consider the information provided herein in the future planning of educational videos from universities or professionals committed to the production of high-quality and reliable content. Another point that should be mentioned is that the audience was predominantly young (less than 34 years old) and female gender. An explanation for this profile includes the characteristics of the dentistry graduate. Therefore, alternatives to reach older age groups should be encouraged.

In conclusion, the present finding supports the concept that a YouTube™ channel is a promising tool for dissemination of health information. Experienced health professionals and universities should lead the production of videos in that platform, aiming to improve the level of knowledge and awareness of the general population on those topics. It would be valuable to produce videos specifically targeting the general population and professionals, considering their level of

knowledge and understanding, to achieve the teaching purposes by balancing the video duration and content.

REFERENCES

1. Hollinderbäumer A, Hartz T, Uckert F (2013) Education 2.0 -- how has social media and Web 2.0 been integrated into medical education? A systematical literature review. GMS Z Med Ausbild 30:Doc14. https://doi:10.3205/zma000857.

2. Dias da Silva MA, Walmsley AD (2019) Fake news and dental education. Br Dent J 226:397-399. https://doi: 10.1038/s41415-019-0079-z.

3. Sadeghi R, Heshmati H (2019) Innovative methods in teaching college health education course: A systematic review. J Educ Health Promot 14:103. https://doi: 10.4103/jehp.jehp_357_18.

4. Seo CW, Cho AR, Park JC, Cho HY, Kim S (2018) Dental students' learning attitudes and perceptions of YoutubeTM as a lecture video hosting platform in a flipped classroom in Korea. J Educ Eval Health Prof 15:24. https://doi:10.3352/jeehp.2018.15.24.

5. Tuells J, Martínez-Martínez PJ, Duro-Torrijos JL, Caballero P, Fraga-Freijeiro P, Navarro-López V (2015) Características de los vídeos en español publicados en Youtube sobre la vacuna contra el virus del papiloma humano. Revista Española de Salud Pública, 89:107-115. https://dx.doi.org/10.4321/S1135-57272015000100012.

6. López-Jornet P, Pons-Fuster E, Ruiz-Roca JÁ (2017) YOUTUBE videos on oral care of the organ or hematopoietic stem cell transplant patients Support Care Cancer 25:1097-1101. https://doi:10.1007/s00520-016-3497-3.

7. Pons-Fuster E, Ruiz Roca J, Tvarijonaviciute A, López-Jornet P (2020) YoutubeTM information about diabetes and oral healthcare. Odontology 108:84-90. https://doi:10.1007/s10266-019-00445-3.

8. Yüce MÖ, Adalı E, Kanmaz B (2021) An analysis of YoutubeTM videos as educational resources for dental practitioners to prevent the spread of COVID-19. Ir J Med Sci 190:19-26. doi: 10.1007/s11845-020-02312-5.

9. Bora K, Das D, Barman B, Borah P (2018) Are internet videos useful sources of information during global public health emergencies? A case study of Youtube™ videos during the 2015-16 Zika virus pandemic. Pathog Glob Health 112:320-328. https://doi: 10.1080/20477724.2018.1507784.

10. Silva FR, Madia DS, Martins LFP, Cunha NS, Umpierre RN (2016) The visibility and coverage of Primary Health Care videos posted by the nucleous of telehealth and telemedicine, Federal University of Rio Grande do Sul on YoutubeTM™ between 2012 and 2014. In: Congresso Brasileiro De Telemedicina E Telessaúde. Jornal Brasileiro de Telessaúde 4:151-152.

11. Hassona Y, Taimeh D, Marahleh A, Scully C (2016) YouTube as a source of information on mouth (oral) cancer. Oral Dis 22:202-208. https://doi:10.1111/odi.12434.

12. Fortuna G, Schiavo JH, Aria M, Mignogna MD, Klasser GD (2019) The usefulness of YouTube™ videos as a source of information on burning mouth syndrome. J Oral Rehabil 46:657-665. https://doi:10.1111/joor.12796.

13. Kovalski LNS, Cardoso FB, D'Avila OP, Corrêa APB, Martins MAT, Martins MD, Carrard VC (2019) Is the YouTube™ an useful source of information on oral leukoplakia? Oral Dis 25:1897-1905. https://doi: 10.1111/odi.13161.

14. Passos KK, Leonel AC, Bonan PR, Castro JF, Pontual ML, Ramos-Perez FM, Perez DE (2020) Quality of information about oral cancer in Brazilian

Portuguese available on Google, Youtube, and Instagram. Med Oral Patol Oral Cir Bucal 25:e346-e352. https://doi:10.4317/medoral.23374.

15. Dias da Silva MA, Pereira AC, Walmsley AD (2019) Who is providing dental education content via YouTube? Br Dent J 226:437-440. https://doi: 10.1038/s41415-019-0046-8.

16. Turkyilmaz I, Hariri NH, Jahangiri L (2019) Student's Perception of the Impact of E-learning on Dental Education. J Contemp Dent Pract 1;20:616-621.

17. Ozdede M, Peker I (2020) Analysis of Dentistry YouTube Videos Related To COVID-19. Braz Dent J 31:392-398. https://doi: 10.1590/0103-6440202003767.

18. Stein PS, Aalboe JA, Savage MW, Scott AM (2014) Strategies for communicating with older dental patients. J Am Dent Assoc 145:159-64. https://doi: 10.14219/jada.2013.28.

19. Schillinger D, Duran ND, McNamara DS, Crossley SA, Balyan R, Karter AJ (2021) Precision communication: Physicians' linguistic adaptation to patients' health literacy. Sci Adv 17;7:eabj2836. https://doi: 10.1126/sciadv.abj2836.

Supplementary material

	Title	Days	Views	Like	Deslikes	Comments	Video duration (Short/Long	User retention (%)	Time of exibition (h)	Subscribers	Interaction index	Viewing rate
1	Not all burning mouth sensation is burning mouth syndrome	2081	102.700	1800	56	92	Short	47,3	4500	820	1,70	4.935,13
2	Radiographic interpretation	2386	39.292	617	12	11	Short	19,5	4800	324	1,54	1.646,77
3	Oral health in the primary care	2728	37.309	374	29	5	Short	15,7	3600	242	0,92	1.367,63
4	Urgencies in densitry	2423	24.531	360	19	10	Short	22,7	2800	235	1,39	1.012,42
5	Dental management of patients under bisphosphonates use	2078	17.320	822	8	20	Short	49,2	1700	253	4,70	833,49
6	Not all oral ulcer is recurrent aphtous stomatitis	1877	12.224	297	5	31	Short	34,6	999,2	70	2,39	651,25
7	Oral cancer diagnosis in the primary health care	2420	11.724	108	5	2	Long	16,8	1400	46	0,88	484,46
8	Patients under bisphosphonates use	2178	8.517	148	3	8	Short	21,9	1100	47	1,70	391,05
9	Oral cancer: dental approach	1181	7.321	310	4	14	Long	16,4	1100	109	4,18	619,90
10	Role of allied dental personel in the detection of oral mucosal lesions	852	4.937	228	0	9	Long	19,7	814,7	67	4,62	579,46
11	Homecare: the role of dentist in public health care	2683	3.724	45	4	5	Long	12,2	378,4	23	1,10	138,80
12	Actinic cheilitis: diagnosis and tratment	1154	3.420	71	5	1	Short	57,8	67,5	10	1,93	296,36
13	Dental traumatism in the primary health care	2050	2.900	38	0	0	Short	25,3	177,6	10	1,31	141,46
14	Oral manifestations of sexually transmitted diseases	618	2.700	91	2	3	Long	9	259,5	24	3,30	436,89
15	How to refer the oral cancer patient to the treatment	772	2.500	110	0	5	Long	12,8	271,1	7	4,40	323,83
16	The importance of dental prenatal care	786	2.200	105	1	6	Long	16,9	354,9	32	4,73	279,90
17	Periodontics: protocol for the public heath services	2178	2.016	18	0	0	Short	10,5	125,9	12	0,89	92,56
18	Management of anchyloglossia in the early childhood	618	1.900	87	0	1	Long	14,3	248,2	20	4,58	307,44
19	Oral health in the pregnancy	2238	1.781	23	0	1	Short	44,8	86,2	2	1,29	79,58
20	How to diagnose bruxism in the child	716	1.600	96	1	7	Long	21,7	258,7	22	5,94	223,46
21	Role of dentist in the school setting	834	1.407	84	1	7	Long	15,7	174,8	24	5,90	168,71
22	Actinic cheilitis: tips for diagnosis	860	1.340	60	0	2	Short	15,2	87,6	10	4,48	155,81
23	Diagnosis and management of oral erosive lesions	2022	1.153	14	1	0	Short	16,3	70,4	7	1,13	57,02
24	Oral health for patients with special needss	828	1.100	48	0	0	Long	9	138,5	13	4,36	132,85
25	Multidisciplinary treatment of anchyloglossia in the children	698	1.100	57	2	4	Long	9,3	121,4	17	5,00	157,59
26	Prevention, diagnosis and treatment of periodontal disease: Latin America consensus	618	976	41	0	0	Long	8,9	69	4	4,20	157,93
27	Red May: all together struggling against oral cancer	786	887	42	2	4	Long	10,9	124,2	4	4,51	112,85
28	Primary health care dentist: How TelessaudeRS-UFRGS can help you?	670	772	48	0	5	Long	10,9	75,4	8	6,22	115,22
29	The role of dentist in the auriculotherapy	833	670	62	1	1	Long	11,8	53	13	9,10	80,43
30	Is possible to perform dental treatment during the pregnancy?	1262	652	22	0	2	Short	74,8	4,9	2	3,37	51,66
31	Oral hygiene	1315	409	26	1	0	Short	66,2	5,43	1	6,11	31,10
32	Periodontics: management in the perspective of the primary health care	2081	159	4	0	0	Short	21,5	7,9	1	2,52	7,64

4 ARTIGO CIENTÍFICO 2

Health technology possibilities for oral medicine: a narrative review

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Statement on conflicts of interest

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Abstract

This study aimed to assess technological tools used to support oral medicine. Systematic searches were conducted using three databases (PubMed, SciELO, and SCOPUS). Descriptions of the characteristics and usability of the support tools were the main outcome measures. The Joanna Briggs Institute protocol was used to assess the risk of study bias. This review identified 135 publications, of which 41 met the inclusion criteria. Most articles were provided by India and published in health technology journals. The majority of the evidence regarding the use of support technology in oral medicine involved the use of mobile apps, cloud-based platforms, and social media. Most studies were descriptive, and the most common findings indicated that technology may be useful for remote patient care, continuing education of professionals, enabling general practitioners to interact with specialists, improving assistance, and reducing geographic barriers. Twenty-six studies (63.41%) were graded as having a low risk of bias. The technological tools used to support oral medicine appear to have the potential to contribute to clinical practice and promote continuing education for health professionals. Supportive technologies in oral medicine may be alternatives to bridge the perceived knowledge gaps, considering their cost, accessibility, and the available evidence to support their use. Future research should access strengths and limitations of the supportive technologies, focusing on the usability tests and impact on the diagnostic abilities of health professionals.

Keywords. dentistry, digital health, health apps, primary health care, public health, telehealth

1. Introduction

Oral medicine pertains to the field of dentistry responsible for the prevention, diagnosis, and treatment of diseases of the oral cavity or oral manifestations of systemic diseases. According to the literature, most of the dentists reported difficulty in identifying and diagnosing these lesions.[1] This difficulty is explained by the insufficient coverage of the field of oral medicine during and after the undergraduate course.[2,3] Since dentists do not believe they are well trained to identify oral lesions with high clinical standards as they do with dental caries or periodontal diseases. Some professionals usually neglect reporting on these lesions during clinical consultations. In contrast, the literature demonstrated a relatively high prevalence of oral lesions in the general population in different countries.[4]

In addition, dentists' lack of knowledge regarding the diagnosis and treatment of oral lesions contributes to increased referral queues to a specialized level in public health services.[1,5] Delayed diagnosis and treatment of oral malignancies are considered to be a predictive factor for poor prognosis[6]. Notably, this factor may be associated with the consistently high mortality rate because of squamous cell carcinoma, the primary malignant lesion of the mouth.[7,8]

The spread of information through wide access to the Internet has been changing the traditional teaching and learning methodologies of health professionals. Telehealth emerges in this sense, supporting professionals with the objectives of assisting in the diagnosis and management of clinical cases and/or health education.[9-11] In addition, health technology in oral medicine aims to transform the dentists and primary care practice to meet global and local

challenges. In terms of support tools, smartphone applications (apps)[12,13], online health platforms[14], and e-mail[15] have been used for telehealth[16].

The difficulty in the detection, diagnosis, and management of oral lesions has lead to a search for tools that improve dentists' knowledge of these lesions. In addition, the efforts of the scientific community are aimed at preventive measures and screening methods to detect oral cancer at an early stage, to reduce the diagnostic delay that in most cases that can save the patient's life. Nowadays, there are several diagnostic tools and visual devices that can improve the ability of the clinician to characterize oral lesions including potentially malignant disorders (PMD) and lesions suspected of oral cancer. Although face-to-face consultation is still considered the "gold standard", ancillary methods should be taken into account due to improve health care effectiveness and at the same time, rationalize the use of available physical and human resources manly in remote areas where access to specialists is limited[1,17].

Thus, the purpose of this narrative review with systematic search was to identify available digital tools used to support oral medicine through the analysis of relevant studies.

2. Material and methods

A literature review with a systematic search was conducted to identify articles that provided data on the following question: "What technologies are available to support oral medicine?"

Eligibility Criteria

Inclusion criteria were descriptive studies that presented the technologies and their respective accuracies, as well as cross-sectional and observational studies that evaluated the use and impact of these technologies. Studies in English and Spanish languages were selected and there was no publication time restriction. Mobile apps, cloud-based platforms, or store-and-forward platforms, digital media such as Whatsapp™, artificial intelligence and optical devices were considered as technologies for use in oral medicine. Reviews, letters, book chapters, personal/expert opinions and meeting abstracts were excluded.

Databases and search strategy

Electronic searches were carried out on PubMed, SciELO, and Scopus using MeSH terms to search for Title/Abstract based on the following strategy (modified for each database): 'oral cancer' OR 'oral pathology' OR 'oral medicine' AND 'cell phone' OR 'mobile applications' OR 'smartphone' OR 'telehealth' OR 'eHealth' OR 'mHealth.' The last search was on March 10th, 2022. To supplement the primary search strategy, references listed in the bibliographies of selected articles were also added if they had not been previously identified.

Study selection

The study selection was conducted in two phases. In phase one, two authors (I.S.S. and M.R.G.) independently screened the titles and abstracts of all the databases. After duplicate removal, titles and abstracts of all studies reviewed by these two authors (I.S.S. and M.R.G.). If the title and abstract met the eligibility

criteria, the study was included. In cases of discrepancies, a third author (V.C.C.) was asked to check them. Studies that did not meet the inclusion criteria were discarded, and those that did not have the necessary information in the abstract for evaluation were entered into phase two. In phase two, full articles were analyzed, and the inclusion criteria were applied. The two authors involved in phase one participated in phase two. The final selection was based on a full-text reading. The reference list for all included articles was assessed by the same two authors for the news articles.

Data extraction

First, one author (I.S.S.) collected the following items from the articles: author, year, country, type of technology, journals, objective, methods (professionals involved and target population), and main results. Subsequently, a second author (M.R.G.) cross-checked the extracted data and confirmed their veracity. In case of disagreements, the decision was based on a discussion between the examiners to define the consensus.

Appraisal of the methodological quality of the included studies

The analysis of risk of bias in the studies was performed independently by two authors (I.S.S. and M.R.G.) in accordance with the Joanna Briggs Institute's Critical Appraisal Checklist for Analytical Cross-Sectional Studies, Case Reports, Prevalence Data, Cohort Studies, Diagnostic Test Accuracy, Qualitative Research, Quasi-Experimental (non-randomized experimental studies), and Randomized Controlled Trials.[18] This analysis is broadly used and is usually structured in a survey that ranges from 8 to 13 questions, according to each study

design. The answers included “yes,” “no,” “unclear (U),” or “not applicable (NA)”. If “NA” was selected, the question was not considered in the calculation. The two authors categorized each study as having a high risk of bias when the “yes” score was up to 49%, moderate when the “yes” score was 50% to 69%, and low when the “yes” score was >70%, according to the authors’ analysis of each article. In case of disagreements, a third author (V.C.C.) intervened to make a final decision.

Summary measures and synthesis of studies

The outcomes evaluated were the types of technology available for oral medicine. Due to the methodological heterogeneity of included studies, this review presented a detailed qualitative synthesis of the results from the included studies.

3. Results

The initial screening retrieved 135 articles from the three databases. After duplicates were removed, there were 117 studies. Out of these, an evaluation of the titles and abstracts resulted in the exclusion of 48 articles. Thus, full-text analysis was performed on 69 articles. Thereafter, 15 studies were identified by reading the reference lists of the selected articles, and 43 were excluded for reasons listed in Figure 1. Finally, 41 articles met the selection criteria and were included in the review (Reference list for Supplementary Information’s A). The results of the search strategy are shown in the flow diagram in Figure 1.

Study characteristics and synthesis of results

The studies that were included were published between 1999 and 2022, with the majority being from 2018 (n=9). The articles were published in journals with different scopes, mainly in health technology journals (n=18, 43.90%), dentistry journals (n=14, 34.15%) including oral medicine journals, general health journals (n=6, 14.63%) and cancer journals (n=3, 7.32%). These studies were conducted in several countries. India (n=13, 31.71%) had the highest number of articles related to the topic, followed by the Brazil (n=8, 19,51%) and United States (n=7, 17.07%). Regarding the studies' designs, most of them were descriptive. Six studies were cross-sectional, three diagnostic, and accuracy test studies, and quasi-experimental, respectively. Other designs, such as cohort study (n=1), a randomized controlled trial (n=1), and was a case study (n=1). were also noted. In the included studies, the most commonly used technology was the mobile app (n=11), followed by the mobile app plus cloud-based platform (n=6), cloud-based platform (n=6), and Whatsapp™ (n=6). Social media channels, including email, were observed in three studies, and one used YouTube™. In addition, technological innovations using optical devices with immunofluorescence in oral medicine were described in four studies, and smartphone plus artificial intelligence were reported in two recently published articles. When the theme was education, dental students, professors, and general dentists were the most common participants. The studies included in this review have demonstrated important benefits from the technological resources available to help in the diagnosis and management of oral lesions, and as a continuing education tool in oral medicine. Notably, training of primary healthcare professionals and providing more access to specialists in oral medicine in low-resource regions were

highlighted in a majority of the studies using these tools. The results of the included studies are presented in Table 1.

Appraisal of the methodological quality of the included studies

When analyzed with the Joanna Briggs Institute's Critical Appraisal Checklist, 26 (63.41%) studies were categorized as having a low risk of bias, nine studies were graded as moderate risk (21.95%), and six as high risk (14.63%), as shown in Table 2. The details are provided in Appendix S1.

4. Discussion

In this review, it was possible to identify studies that offered alternative support in oral medicine using different technological tools. The findings indicated that these tools may provide support for diagnosis of oral lesions, remote patient care, training and continuing education of professionals, and exchange of information among health professionals.

The dentist is a health professional responsible for the routine examination of the oral mucosa, identification, treatment, and/or referral of patients with oral lesions.[19,20] However, it is well known that many dentists experience difficulties in identifying and diagnosing oral lesions[21]. Fortunately, the present study showed that the use of support technologies appears to be useful, offering benefits and having an impact on the clinical routine.

The main concern reported by these studies, regardless of the tool used, is the uncertainty of the real contribution of those resources in relation to the early diagnosis of potentially malignant disorders and malignant lesions. Birur et al.[22]

identified 5406 potentially malignant disorders after assessing 42,754 patients, whereas Bhatt et al.[23] identified that 5% of individuals in a group of 8,686 people who were assessed online had positive results for oral cancer. Additionally, another study, which used an application developed for a smartphone, with a convenience sample of 55 individuals showed that 31% of the patients had white lesions with potential for malignancy.[24] These studies pointed to the need for further controlled clinical trials, which may involve artificial intelligence, to evaluate whether these technological tools may improve detection of lesions.

Some studies presented mixed tools; that is, the smartphone was used to photograph the lesions, and these photos were fed into a system that the specialist had access to.[22,23,25,26] These authors presented these tools mainly to propose these as an alternative to professionals and patients from remote places, which often makes in-person consultation with the specialist unfeasible. Because of this, limitations include the quality of the images, as not all of them could be interpreted properly. The advantages of avoiding patient travel for conventional consultation and the possibility of using these tools to facilitate resolution in primary health care have been discussed.[22-26] Moreover, Petruzzi and De Benedetti[27] evaluated the use of Whatsapp™ to guide patients and professionals in the management of 96 patients with oral lesions, wherein 68% of the patients with face-to-face consultations resided in rural areas or poorly served areas. The tool may aid in removing the geographical distance while obtaining accurate information regarding a clinical issue, increasing the value of face-to-face evaluation and increasing early diagnostic rates.

Leão and Porter[28] developed one of the first studies involving teledentistry. This research proposed a discussion of oral lesion cases, using email to send

photos to specialists, and showed a satisfactory acceptance by the patients to the procedure of having a photo taken of their oral cavity. In a study by Torres-Pereira et al. in 2008[15], two experts also used emailed images to evaluate 25 cases. In 88% of the cases, there was at least one correct diagnosis by the specialists. The study was repeated in 2013 with 60 patients, and correct diagnoses were obtained in 80% of the cases.[29] These studies demonstrate the feasibility of teledentistry for the diagnosis of oral mucosal lesions.

Some studies have reported methods based on fluorescence with the aid of smartphones, which have been used for premalignant oral screening.[30,31] Uthoff et al.[31] described the dual-modality, dual-view, point-of-care oral cancer screening device used in high-risk populations in remote regions with limited infrastructure. Although the authors reported good sensitivity, specificity, and a low-cost device, some issues should be highlighted. First, the use of these devices requires the training of health providers. Second, costs can be lowered only when these devices are used on a large scale. In addition, technological support tools can be a means of reducing the number of patient referrals to specialists, as shown by Blomstrand et al.[33], in which 80% of the patients evaluated could be diagnosed online, avoiding unnecessary face-to-face consultation with specialist. Likewise, in the study by Carrard et al.[14], the need to assess the patient in person decreased from 96.9% to 35.1% as case discussion with a specialist increased the self-efficacy for maintaining the patient at the primary health care center.

The pandemic decreed in 2020 by the World Health Organization (WHO) due to the spread of “coronavirus disease 2019” (Covid-19) induced a change in dental practice. This change stimulated and strengthened online models through

teledentistry and support with media, such as Whatsapp™, due to the need to reduce the risk of contagion.[34] Amid these technological advancement opportunities, there is still a great challenge for oral medicine, such as earlier diagnosis of oral cancer. In this sense, we suggest programs in primary and secondary healthcare to assist in searching actively for the population exposed to risk factors, continuing education for primary healthcare professionals to recognize potentially malignant disorders and improving access to specialized centers.

Conclusion

The use of multiple platforms and online environments improves the provision of health care services access. In addition, the tools available and evaluated in this review are a beneficial and easily accessible support process for health professionals who especially work in oral medicine and contribute to the diagnosis of oral lesions.

Future perspectives

Supportive technologies in oral medicine may be alternatives even after the pandemic, especially considering the cost, accessibility, and available evidence.

References

1. Strey JR, Roxo-Gonçalves M, Guzenski BD, Martins MAT, Romanini J, de Figueiredo MAZ, et al. Oral Medicine Experience and Attitudes Toward Oral Cancer: An Evaluation of Dentists Working in Primary Health Care. J Cancer Educ. 2021. doi: 10.1007/s13187-021-01999-z. Epub ahead of print.

2. Wan A, Savage NW. Biopsy and diagnostic histopathology in dental practice in Brisbane: usage patterns and perceptions of usefulness. Aust Dent J 2010; 55:162-9. doi: 10.1111/j.1834-7819.2010.01210.x.

3. Razavi SM, Zolfaghari B, Foroohandeh M, Doost ME, Tahani B. Dentists' knowledge, attitude, and practice regarding oral cancer in Iran. J Cancer Educ 2013; 28:335-41. doi: 10.1007/s13187-013-0460-6.

4. López Jornet P, Velandrino Nicolás A, Martínez Beneyto Y, Fernández Soria M. Attitude towards oral biopsy among general dentists in Murcia. Med Oral Patol Oral Cir Bucal 2007;12:E116-21.

5. Seoane-Lestón J, Velo-Noya J, Warnakulasuriya S, et al. Knowledge of oral cancer and preventive attitudes of Spanish dentists. Primary effects of a pilot educational intervention. Med Oral Patol Oral Cir Bucal 2010; 15:e422-6. doi: 10.4317/medoral.15.e422.

6. Seoane J, Varela-Centelles P, Tomás I, Seoane-Romero J, Diz P, Takkouche B. Continuing education in oral cancer prevention for dentists in Spain. J Dent Educ 2012;76(9):1234–1240.

7. Chan JKC, El-Naggar AK, Grandis JR, Takata T, Slootweg PJ. WHO Classification of Head and Neck Tumours. World Health Organization, 2017; 4th edition.

8. Câncer, Instituto Nacional de. “Atlas on-Line de Mortalidade.” Inca Rio de Janeiro.

9. Iglesias-Posadilla D, Gómez-Marcos V, Hernández-Tejedor A. Apps and intensive care medicine. Med Intensiva 2017; 41:227-236. doi: 10.1016/j.medin.2017.01.003.

10. Payne KB, Wharrad H, Watts K. Smartphone and medical related App use among medical students and junior doctors in the United Kingdom (UK): a regional survey. BMC Med Inform Decis Mak 2012; 30:121. doi: 10.1186/1472-6947-12-121.

11. Nuss MA, Hill JR, Cervero RM, Gaines JK, Middendorf BF. Real-time use of the iPad by third-year medical students for clinical decision support and learning: a mixed methods study. J Community Hosp Intern Med Perspect 2014; 29:4. doi: 10.3402/jchimp.v4.25184.

12. Ventola CL. Mobile devices and apps for health care professionals: uses and benefits. P T. 2014; 39:356-64.

13. Mohapatra DP, Mohapatra MM, Chittoria RK, Friji MT, Kumar SD. The scope of mobile devices in health care and medical education. Int J Adv Med Health Res 2015; 2:3-8. doi: 10.4103/2349-4220.159113.

14. Carrard VC, Roxo Gonçalves M, Rodriguez Strey J, et al. Telediagnosis of oral lesions in primary care: The EstomatoNet Program. Oral Dis 2018; 24:1012-1019. doi:10.1111/odi.12851.

15. Torres-Pereira C, Possebon RS, Simões A, et al. Email for distance diagnosis of oral diseases: a preliminary study of teledentistry. J Telemed Telecare 2008; 14:435-438. doi:10.1258/jtt.2008.080510.

16. da Costa CB, Peralta FDS, Ferreira de Mello ALS. How Has Teledentistry Been Applied in Public Dental Health Services? An Integrative Review. Telemed J E Health 2020; 26:945-954. doi: 10.1089/tmj.2019.0122.

17. Cardozo, Ivy et al. “Telehealth in Oral Medicine: report of an experience from public health care in a southern Brazilian state.” Brazilian oral research 2022;36:e031. doi:10.1590/1807-3107bor-2022.vol36.0031

18. Joanna Briggs Institute. Joanna Briggs Institute Reviewers’ Manual: 2014 Edition. The Systematic Review of Prevalence and Incidence Data. Adelaide: The University of Adelaide. Available from: http://joannabriggs.org/assets/docs/sumari/ReviewersManual-2014.pdf.

19. Alston PA, Knapp J, Luomanen JC. Who will tend the dental safety net? J Calif Dent Assoc 2014; 2:112-8.

20. American Academy of Oral Medicine (AAOM). Subject: oral cancer screening [accessed 2020 Dec 12] 2019. https://www.aaom.com/clinical-practicestatement-oral-cancer-screening

21. Epstein JB, Güneri P, Boyacioglu H, Abt E. The limitations of the clinical oral examination in detecting dysplastic oral lesions and oral squamous cell carcinoma. J Am Dent Assoc 2012; 143:1332-42. doi: 10.14219/jada.archive.2012.0096.

22. Birur NP, Patrick S, Bajaj S, et al. A Novel Mobile Health Approach to Early Diagnosis of Oral Cancer. J Contemp Dent Pract 2018; 19:1122-1128.

23. Bhatt S, Isaac R, Finkel M, Evans J, Grant L, Paul B, Weller D. Mobile technology and cancer screening: Lessons from rural India. J Glob Health 2018; 8:020421. doi:10.7189/jogh.08.020421.

24. Gomes MS, Bonan PR, Ferreira VY, et al. Development of a mobile application for oral cancer screening. Technol Health Care 2017; 25:187-195. doi: 10.3233/THC-161259.

25. Birur PN, Sunny SP, Jena S, et al. Mobile health application for remote oral cancer surveillance. J Am Dent Assoc 2015; 146:886-894. doi:10.1016/j.adaj.2015.05.020.

26. Anantharaman R, Anantharaman V and Lee Y. "Oro Vision: Deep Learning for Classifying Orofacial Diseases." 2017; IEEE International Conference on Healthcare Informatics (ICHI), Park City, UT 2017; 39-45. doi: 10.1109/ICHI.2017.69.

27. Petruzzi M, De Benedittis M. WhatsApp: a telemedicine platform for facilitating remote oral medicine consultation and improving clinical examinations. Oral Surg Oral Med Oral Pathol Oral Radiol 2016; 121:248-254. doi:10.1016/j.oooo.2015.11.005.

28. Leao JC, Porter SR (1999) Telediagnosis of oral disease. Braz Dent J. 10:47-53.

29. Torres-Pereira CC, Morosini Ide A, Possebon RS, et al. Teledentistry: distant diagnosis of oral disease using e-mails. Telemed J E Health 2013; 19:117-121. doi:10.1089/tmj.2012.0087.

30. Khan S, Hussain MAB, Khan AP. Clinical evaluation of smartphone-based fluorescence imaging for guidance and monitoring of ALA-PDT treatment of early oral cancer. J Biomed Opt 2020; 25:1-10. doi:10.1117/1.JBO.25.6.063813.

31. Uthoff RD, Song B, Sunny S, et al. Point-of-care, smartphone-based, dual-modality, dual-view, oral cancer screening device with neural network classification for low-resource communities. PLoS One 2018; 13: e0207493. doi:10.1371/journal.pone.0207493.

32. Birur NP, Gurushanth K, Patrick S, et al. Role of community health worker in a mobile health program for early detection of oral cancer. Indian J Cancer 2019; 56:107-113. doi: 10.4103/ijc.IJC_232_18.

33. Blomstrand L, Sand LP, Gullbrandsson L, Eklund B, Kildal M, Hirsch JM. Telemedicine--a complement to traditional referrals in oral medicine. Telemed J E Health 2012; 18:549-53. doi: 10.1089/tmj.2011.0207.

34. Giudice A, Barone S, Muraca D, et al. Can Teledentistry Improve the Monitoring of Patients during the Covid-19 Dissemination? A Descriptive Pilot Study. Int J Environ Res Public Health 2020; 17:3399. doi:10.3390/ijerph17103399.

Tables

Table 1. Summary characteristics of included studies.

Author (Year) Country	Thematic	Objective	Target population	Professionals	Main results
Mobile app plus cloud-based platform					
Birur et al. (2015) India	Diagnosis	To determine the effectiveness of a mobile phone-based remote oral cancer surveillance program (Oncogrid) connecting different categories of professionals.	Rural and suburbs population (n = 3.440)	Primary health care professionals, dental professionals and remote specialist	In the targeted cohort, (61%) interpretable images, (45%) of the lesions were confirmed by specialists, while the opportunistic cohort showed 100% concordance with the specialists. The mobile health-based aided remote early detection of oral cancer by primary care dental practitioners in a resource-constrained setting.
Birur et al. (2018) India	Diagnosis	To empower primary health care professionals for early detection and connect specialist to rural population through mHealth.	Rural population (n=42.754)	Frontline Healthcare Providers (FHPs) and general dentist and remote specialist.	The potentially malignant disorders varied from 0.8 to 62%. Connecting specialists and trained FHPs and general dentists to rural population was made possible through the use of mobile health. The program was very cost effective, with screening completed under.
Birur et al. (2019) India	Diagnosis	To assess the use of mHealth by community health workers in the identification of oral mucosal lesions.	Pipeline factory	Community health workers (CHWs), onsite and remote oral medicine specialist	Perfect agreement (kappa 0.92): between the CHWs and the onsite specialist. Substantial agreement (0.62) between health CHWs and remote specialist. The trained health workers can aid in oral cancer-screening mHealth effectivity
Bhatt et al. (2018) India	Diagnosis	To determine the key features of an ideal mHealth prototype for use in cancer screening, the views of health in the delivery of the programme and the response of the target population.	Underserved populations (n= 8.686)	Health workers – non specified	The mHealth prototype was very acceptable to health workers and has had a positive effect on the social standing of the health. Barriers such as screening and follow-up in test-positive individuals were identified.
Anantharaman et al. (2017) USA	Diagnosis	To provide an assessment tool “Oro Vision” for field workers to perform initial examinations of orofacial diseases, using a camera enabled mobile phone.	Images obtained from Google™ (n=75)	Field workers - non specified	The initial feasibility demonstrated that the “Oro Vision” could be utilized on the field to do some preliminary diagnosis of oral health problems.
Desai et al. (2015) India	Diagnosis	To evaluate the tobacco effect on oral mucosa and correlated with histopathology through a mobile health approach (mHealth).	Factory employees (n= 582)	Frontline healthcare workers and remote specialist	Use of mHealth empowered frontline healthcare workers to identify lesions and enable remote diagnosis by specialist in resource-constrained settings. Biopsy was performed for 71(12.2%) subjects.
Mobile app					
Al-Rawi et al. (2015) India	Education	To evaluate and compare students’ perception and	Dental students (n=107)	Dental School Professors	The acceptance of this technology with respect to usefulness was similar between

		utilization of an electronic spaced repetition oral pathology-radiology system in dental hygiene education and predoctoral dental education.	Dental hygiene students (n=22)		groups (median=5 on a five-point scale). Only a minority of the survey respondents (25% dental, 33% dental hygiene) took advantage of one of the main benefits of this technology: automated spaced repetition.
Deshpande et al. (2019) India	Education and diagnosis	To develop a mobile app for education and screening regarding oral cancer in the general population.	Rural population (n=50)	Healthcare providers - non specified	Overall feedback was very positive. They found the app easy to operate, enhancing knowledge regarding oral cancer, and recommended this to be used for the general population.
Gomes et al. (2017) Brazil	Diagnosis	To develop a mobile application (app) for oral cancer screening.	Population at high risk for oral cancer (n=55)	Examiners with experience in oral diagnosis	A total of 31% presented lesions with potential of malignancy. Sensitivity of 82%–100%, specificity (81%–100%), and accuracy of (87.27%–95.54%), were found.
Haron et al. (2020) Malasia	Diagnosis	To evaluate the feasibility of using Mobile Mouth Screening Anywhere (MeMoSA®) to facilitate early detection of oral cancer.	Patients (n=48)	Dentists and specialists	Twelve patients were found to have oral lesions and 3 required referrals. All dentists agreed that MeMoSA could facilitate early detection of oral cancer and assist in the identification of oral mucosal lesions through direct communication with specialists.
Haron et al. (2021) Malasia	Diagnosis	To evaluate the accuracy of MeMoSA®, a mobile phone application to review images of oral lesions in identifying oral cancers and oral potentially malignant disorders.	Patients	Specialists in oral medicine or oral surgery	Kappa values comparing MeMoSA® with clinical oral examination in detecting a lesion and referral decision was 0.604 and 0.892, respectively. Sensitivity and specificity for referral decision were 94.0% and 95.5%. Inter-rater agreement for a referral decision was 0.825. Referral decisions made through MeMoSA® is highly comparable to clinical examination.
Ramesh et al. (2022) India	Diagnosis	To assess the use of mobile phone-based application by community health workers in the identification of oral Potentially Malignant Lesions (OPMLs)	Patients	Community health workers (CHWs), onsite and remote oral medicine specialist	Nearly 700 (26%) participants were identified with OPMLs. The sensitivity, specificity, positive predictive values, negative predictive values and accuracy of the CHW was 70.3, 88.4, 66.8, 89.9% and 83.7% respectively. Such programmes, with the recommendations from remote specialists, will facilitate early detection in remote settings.
Shekar et al. (2018) USA	Education	To evaluate a smartphone application, SIMPL, to optimize faculty guidance and oral medicine residents' performance, and to measure resident–faculty agreement for performance and supervision levels.	Oral medicine junior residents and senior residents	Dental School Professors	A total of 660 evaluations were performed. Faculty–resident concordance was 86.1% for performance and 92.4% for supervision. SIMPL can feasibly be used for real-time assessment of residents' performance and autonomy.
Subramanian et al. (2021) USA	Education	To develop a mobile application (M-OncoED) to educate physicians on cervical, breast, and oral cancer screening and tested the acceptability, utility, and cost of two different approaches to recruit physicians.	Physicians	Physicians	Cervical cancer screening knowledge increased by about 30 percentage points, and breast cancer screening knowledge increased by 10 percentage points. There was no change in knowledge for oral cancer scorings.

Tesfalul et al. (2013) USA	Diagnosis (impact)	To assess the impact of the services of mobile oral telemedicine system for diagnosis and management plan	Patients (n=25)	Clinician and specialists	Of cases with diagnoses from both the submitting clinician and specialist, the diagnosis of the submitting clinician was on the specialist's differential in 92.0% (23/25) cases.
Tesfalul et al. (2016) USA	Diagnosis (impact)	To explorer the potential impact of a mobile oral telemedicine system on the oral health specialty referral system in Botswana	Eligible case (n=26)	Dentists and specialists	High diagnosis concordance (91.3%), but significant management plan discordance (64.0%) was found. The specialists disagreeing with the referring clinicians about the need for a visit to a specialist. The mobile telemedicine can optimize the use of insights and skills of specialists remotely in regions where they are scarce.
Tovio-Martinez et al. (2020) Colombia	Education	To design, implement and assess the use of a mobile application in the teaching of elementary lesions of the oral cavity.	Dental Students	Dental School Professors	Although both groups showed an improvement in learning, the group that used the mobile application achieved significantly better results.
Cloud-based platform					
Aguilar et al. (2018) Cuba	Education	To elaborate a multimedia for the study of the Oral Medicine-I subject in third year of dentistry studies.	Dentistry students	Dental School Professors	The multimedia resulted in positive assessment from the users and the experts. They consider generalization to facilitate the teaching-learning process.
Bradley et al. (2010) Northern Ireland	Diagnosis	Describe the feasibility study from a teledentistry prototype system in Community Dental Clinic (thereafter 'teledentistry site') linked to the School of Dentistry Belfast.	Community Dental Clinic patients (n=41)	Community clinician and consultant in oral medicine	Despite the limitations, this study demonstrates that using teledentistry in the management of patients with oral mucosal disease can work successfully.
Carrard et al. (2018) Brazil	Diagnosis, treatment and follow-up	To summarize the experience of the EstomatoNet, a telediagnosis program catering to primary care from southern Brazil.	Primary care patients	Health providers (dentists and physicians from primary care) and consultant in oral medicine	Actinic cheilitis (15.8%), squamous cell carcinoma (8.5%), and inflammatory hyperplasia (21, 8.1%) were the most frequent diagnoses. After the EstomatoNet use, the intention to refer the patients to face-to-face consultation reduced from 96.9% to 35.1%.
Falkman et al. (2008) Sweden	Education and diagnosis	(1) Study the communication of health care professionals in oral medicine; (2) Apply Semantic Web technologies to describe community data and oral medicine knowledge; (3) Develop an online CoP, Swedish Oral Medicine Web (SOMWeb), centered on user-contributed case descriptions and meetings; and (4) Evaluate SOMWeb.	General dentists	General practitioner dentists, hospital dentists, specialists in jaw surgery and oral medicine, professors, and some oral pathologists	The introduction of SOMWeb (n=90 users) has improved the structure of meetings and their discussions. Barriers to submitting cases are described. The system provides an opportunity for its members to share both high quality clinical practice knowledge and external evidence.
Roxo-Gonçalves et al. (2017) Brazil	Education	To evaluate the diagnostic skills of primary healthcare professionals regarding oral cancer and	Primary healthcare professionals (dentists and nondentists)	Oral medicine specialists	Both dentists and non-dentists (n=27) have a fairly good capacity for discriminating the nature of oral lesions and had low attendance in the course. Specialists performed somewhat better, however, the difference was not statistically significant.

		presented them with an e-learning course.			
Velázquez et al. (2018), Cuba	Education	To create educational software to support the teaching-learning process of the elective course Nutrition in Dentistry Care.	Students of dentistry (n=51)	Dental School Professors	The educational software favored the teaching-learning process, encouraging the development of a comprehensive graduate with a high level of scientific knowledge.
Whatsapp™					
Giudice et al.(2020) Italia	Diagnosis, treatment and follow-up	To describe the advantages of telemedicine in dental practice during the current emergency condition due to the Covid-19 dissemination using WhatsApp™	Patients of Health Science of Oral Surgery and Pathology department (n=57)	Dental School Professions	A total of 418 photos were collected by 57 patients including urgent conditions and patients in follow-up. Telemedicine allowed the monitoring of patients, reducing costs and decreasing the risk of Covid-19 dissemination.
Koparal et al. (2019) Turkey	Diagnosis, treatment and follow-up	To evaluate the efficiency of WhatsApp™ messaging as a mode of consultation within an oral and maxillofacial surgery team.	Hospital Patients	Oral and maxillofacial surgeon	A total of 1747 messages of different types. Most consultations were resolved (64.4%). WhatsApp is simple, free, and allows efficient consultation when consultants are not in the hospital.
Nayak, et al. (2018) India	Education	To assess the effectiveness of WhatsApp™ as a tool for providing health education on tobacco and oral cancer as compared to the conventional health education via PowerPoint.	Students of the Bachelor of Commerce (n=182)	Dentists	The increase in knowledge was seen in both groups, with significant improvement in the intervention group. WhatsApp can be a more effective tool for providing dental education as compared to conventional audio-visual aids.
Perdoncini et al. (2021) Brazil	Diagnosis	To assess the feasibility and accuracy of synchronous teleconsultation in oral medicine using WhatsApp™.	Patients	General dentists and remote specialist in oral medicine	Thirty-three patients had 41 oral lesions. The average teleconsultation length was approximately 10 minutes. In 92.7% of the cases, there was concordance between the telediagnosis and the reference standard (κ = 0.922). Synchronous teleconsultation can provide reliable remote diagnosis in management of oral lesions.
Petruzzi and De Benedittis (2016) Italia	Diagnosis	To describes use of the smartphone-based application Whatsapp® to share clinical oral medicine information.	Rural population	General dentists, physicians, dental hygienists and remote specialist	The images (n=339) were received for 96 patients; 95.8% patients underwent clinicopathologic examination, and 49% received a biopsy. The most common question was related to diagnosis (56%). The telemedicine impression agreed with the clinicopathologic assessment for 82% of cases.
Vinayagamoorthy et al. (2019) India	Diagnosis	To assess the feasibility of using a remote sensing model as a free messaging tool in the preventive screening of oral potentially malignant disorders in a rural area of India.	Rural population	Primary care service – non specified	A total of 131 individuals (655 images) were screened. There was a substantial agreement between the diagnosis based on clinical examination and WhatsApp image for both the examiners. Screening using photo messaging can serve as an effective adjunct and a potential cost-effective tool in a low-resource setting.
E-mail					

Torres-Pereira et al. (2008) Brazil	Diagnosis	To examine the feasibility of distance diagnosis of oral diseases, using transmission of digital images by email.	Rural population	Dentists and oral medicine specialists	In 88% of cases, at least one consultant was able to provide the correct diagnosis. The use of information technology can increase the accuracy of consultations in oral medicine.
Torres-Pereira et al. (2013) Brazil	Diagnosis	To evaluate the applicability of telediagnosis in oral medicine, through the transmission of clinical digital images by e-mail.	Dental school patients (n=60)	Dentists and consultants (specialists in oral medicine)	Of 60 cases (51.7%), both consultants made the correct diagnosis. In 80%, at least one consultant was able to provide the correct diagnosis. The use of information technology can increase the accuracy of consultations in oral medicine.
Leão & Porter (1999) England	Diagnosis	To determine the acceptability to patient and clinician of the distant diagnosis of common orofacial diseases using the Internet.	Dental School patients (n=20)	Qualified clinical and nonclinical dentists	The majority of patients (75%) found the procedure comfortable. They suggest that telediagnosis of orofacial disease may be a feasible prospect.
Youtube™					
Kovalski et al. (2019) Brazil	Education	To analyze the quality of English language videos on oral leukoplakia available on YouTube™.	Videos obtained from YouTube™	Non specified	Videos were categorized into independent users or company advertisements (n=21) and professional organizations or government agencies (n = 5). Overall, the videos were of low quality. Oral medicine professionals and students should attempt to correct this deficit.
Optical devices					
Khan et al. (2020) India	Treatment and follow-up	To assess the capability of a simple smartphone-based device for imaging 5-aminolevulinic acid (ALA)-induced protoporphyrin IX (PpIX) fluorescence for treatment guidance and monitoring.	Cancer patients (n=29)	Dentists	The comparative analysis of pre- and post-treatment of Smartphone-based fluorescence and white light and ultrasound images of oral lesions showed agreement in most cases. They suggest that approach can be a useful tool to aid in guidance photodynamic therapy and monitoring photobleaching.
Song et al. (2018) India	Diagnosis	To present an image classification approach based on autofluorescence and white light images using deep learning methods.	Patients	Non specified	The experimental results demonstrate the effectiveness of deep learning methods in classifying dual-modal images for oral cancer detection.
Uthoff et al. (2019) USA	Diagnosis	To present an imaging device to assist in the early detection and diagnosis of precancerous or cancerous conditions.	Patients	Non specified	The small size and flexible imaging head improve on previous intraoral probe designs and allows imaging the areas of greatest risk for both causes of oral cancer.
Uthoff et al. (2018) India	Diagnosis	To describe dual-modality, dual-view, point-of-care oral cancer screening device, developed for high-risk populations in remote regions with limited infrastructure.	Patients	Frontline health worker (dentists, nurses or any community member) and remote specialist remote populations with low doctor-to-patient ratios, the ideal AFI system is operable by any	The remote specialist and a convolutional neural network were able to classify 170 image pairs into 'suspicious' and 'not suspicious' with sensitivities, specificities, positive and negative predictive values, ranging from 81.25% to 94.94%. The initial feedback on the system is positive and performance should increase as additional images are collected.

				frontline health worker in primary health centers, dentists, nurses, or by any community member	
Smartphone					
Fonseca et al. (2021) Brazil	Diagnosis	To evaluate telediagnosis of oral lesions using smartphone photography.	Patients	Specialists in oral medicine*	The telediagnosis was similar to the gold standard in 76% of the cases, and kappa coefficients showed almost perfect agreement (k = 0.817-0.903). The evaluators considered that referrals could have been avoided on an average of 35,4% of the cases. Diagnosis of oral lesions using images taken with a smartphone showed almost perfect agreement and diagnostic accuracy comparable to face-to-face diagnosis.
Wang et al. (2020), China	Diagnosis	To develop an operating classification for tongue coating diagnosis and to determine the intra-rater and inter-rater reliability.	Patients of Chinese medicine clinics	Traditional Chinese medicine (TCM) students (n=4), TCM clinician (n=18), clinicians and research collaborators (n=17)	A representative tongue image set (n=24) were compared. Intra-rater agreement between direct subject inspection and tongue image inspection was good to very good. The findings support the use of smartphones in telemedicine for detecting changes.
Smartphone plus artificial intelligence					
Lin et al. (2021) China	Diagnosis	To present a smartphone-based imaging diagnosis method, powered by a deep learning algorithm, to address the challenges of automatic detection of oral diseases.	Patients of Chinese Hospital including healthy people and those who are clinically diagnosed with aphthous ulcers, OPMD, or oral cancer.	General dentists and oral medicine specialists	The performance of the proposed method achieved a sensitivity of 83.0%, specificity of 96.6%, precision of 84.3%, and $F1$ of 83.6% on 455 test images. The smartphone-based imaging with deep learning method has good potential for primary oral cancer diagnosis.
Song et al. (2021) India	Diagnosis	To develop a mobile-based dual-mode image method and customized Android application for point-of-care oral cancer detection.	Patients	Oral medicine specialists	The results demonstrated achieved 81% accuracy for distinguishing normal/benign lesions from clinically suspicious lesions, using a gold standard of clinical impression based on the review of images by oral specialists. They demonstrate the effectiveness of a mobile-based approach for oral cancer screening in low-resource settings.

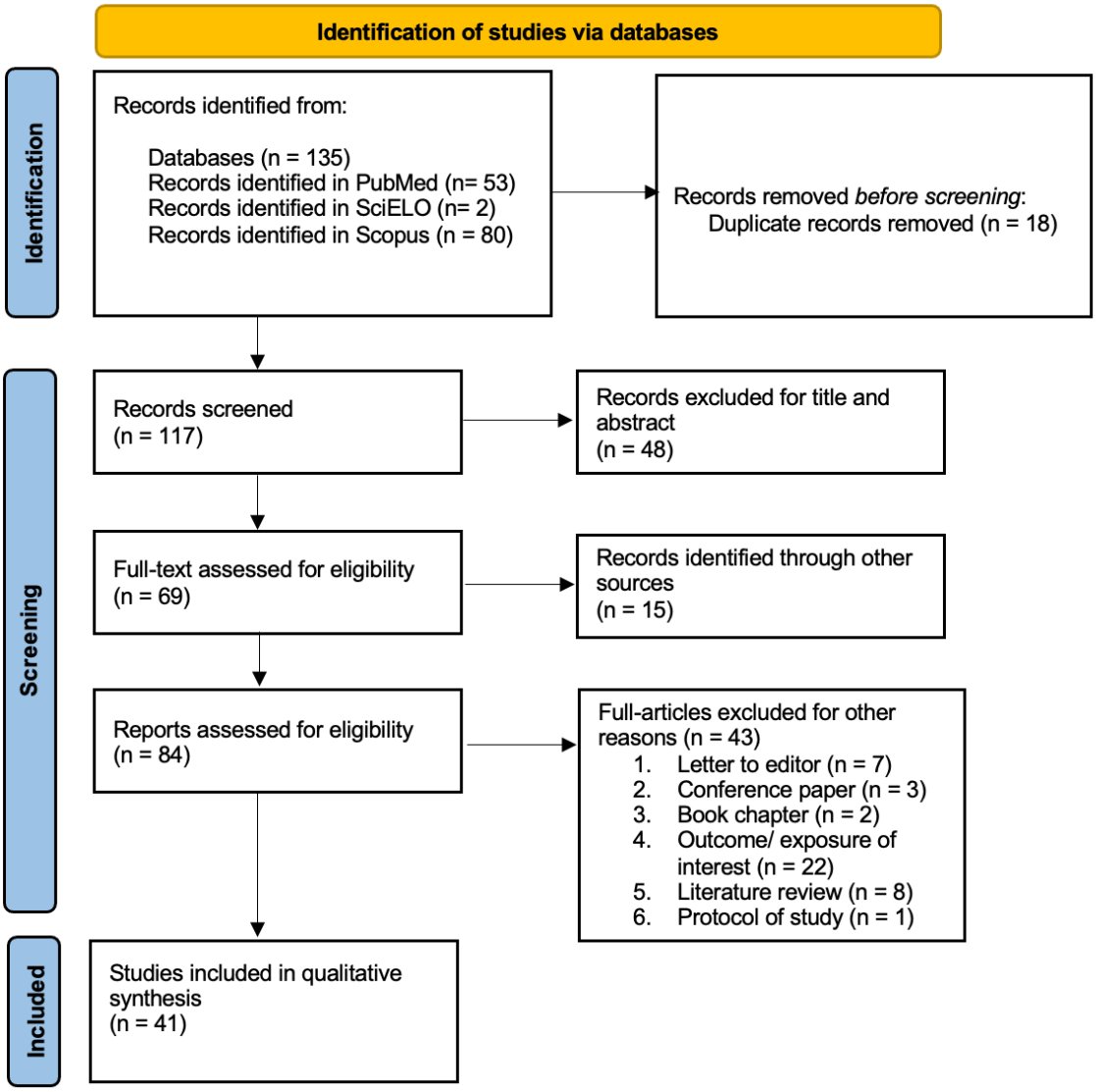
Table 2. Risk of bias in individual studies.

Authors (Year)	Journal	Study design	Risk of bias
Aguilar et al. (2018)	Revista Cubana de Informática Médica	Cross-sectional	M
Al-Rawi et al. (2015)	Journal of Dental Education	Cross-sectional	M
Anantharaman et al. (2017)	IEEE - International Conference on Healthcare Informatics	Descriptive study	M
Bhatt et al. (2018)	Journal of Global Health	Descriptive study	L
Birur et al. (2015)	The Journal of the American Dental Association	Descriptive study	L
Birur et al. (2018)	The Journal of Contemporary Dental Practice	Descriptive study	H
Birur et al. (2019)	Indian Journal of Cancer	Descriptive study	L
Bradley et al. (2010)	British Dental Journal	Descriptive study	L
Carrard et al. (2018)	Oral Diseases	Descriptive study	L
Desai et al. (2015)	The Journal of Contemporary Dental Practice	Cohort Study	M
Deshpande et al. (2019)	The journal of Contemporary Dental Practice	Descriptive study	L
Falkman et al. (2008)	Journal of Medical Internet research	Qualitative research	L
Fonseca et al. (2021)	Oral Diseases	Descriptive study	L
Giudice et al. (2020)	International Journal of Environmental Research and Public Health	Descriptive study	L
Gomes et al. (2017)	Technology and Health Care	Descriptive study	L
Haron et al. (2020)	Telemedicine Journal and E Health	Descriptive study	L
Haron et al. (2021)	Oral Diseases	Diagnostic test Accuracy study	L
Khan et al. (2019)	Journal of biomedical optics	Descriptive study	L
Koparal et al. (2019)	International Journal of Medical Informatics	Descriptive study	H
Kovalski et al. (2019)	Oral Diseases	Descriptive study	H
Leão & Porter (1999)	Brazilian Dental Journal	Descriptive study	H
Lin et al. (2021)	Journal of Biomedical Optics	Descriptive study	M
Nayak et al. (2018)	Journal of Cancer Education	Randomized clinical trial	L
Perdoncini et al. (2021)	The Journal of the American Dental Association	Descriptive study	L
Petruzzi and De Benedittis (2016)	Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology	Descriptive study	M
Ramesh et al. (2022)	Tropical doctor	Descriptive study	M

Roxo-Gonçalves et al. (2017)	Telemedicine Journal and e-health	Cross-sectional	L
Shekar et al. (2018)	Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology	Descriptive study	L
Song et al. (2018)	Biomedical Optics Express	Quasi-experimental	H
Song et al. (2021)	Journal of Biomedical Optics	Descriptive study	L
Subramanian et al. (2021)	The oncologist	Descriptive study	L
Tesfalul et al. (2013)	Studies in Health Technology and Informatics	Descriptive study	H
Tesfalul et al. (2016)	Journal of the American Medical Informatics Association	Descriptive study	L
Torres-Pereira et al. (2008)	Journal of Telemedicine and Telecare	Diagnostic test Accuracy study	L
Torres-Pereira et al. (2013)	Telemedicine and e-Health	Diagnostic test Accuracy study	L
Tovio-Martínez et al. (2020)	Universidad y Salud	Quasi-experimental	L
Uthoff et al. (2018)	Plos One	Descriptive study	L
Uthoff et al. (2019)	Journal of Biomedical Optics	Case study	L
Velázquez et al. (2018)	Revista Cubana de Informática Médica	Descriptive study	M
Vinayagamoorthy et al. (2019)	The Australian Journal of Rural Health	Cross-sectional	M
Wang et al. (2020)	JMIR mHealth and UHealth	Quasi-experimental	L

Figure Legend

Figure 1. Flow diagram of the screening process.



Supplementary Information

Appendix S1: Critical appraisal of studies

Tool used: Risk of Bias – Joanna Bringgs Institute Critical Appraisal Tools

Y= Yes N= No U= Unclear NA= Not applicable

A. Checklist for Descriptive Studies (Analytical Cross-Sectional Studies)

Author (Year)	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**% /Risk**
Aguilar et al. (2018)	Y	Y	U	Y	N	U	Y	Y	**62.5/M**
Al-Rawi et al. (2015)	Y	Y	Y	U	N	U	Y	Y	**62.5/M**
Anantharaman et al. (2017)	N	N	Y	Y	Y	U	Y	Y	**62.5/M**
Bhatt et al. (2018)	Y	Y	Y	Y	N	N	Y	NA	**71.4/L**
Birur et al. (2015)	Y	Y	Y	Y	Y	N	U	Y	**75.0/L**
Birur et al. (2018)	N	N	Y	Y	U	N	U	U	**37.5/H**
Birur et al. (2019)	Y	Y	Y	Y	N	NA	Y	Y	**85.7/L**
Bradley et al. (2010)	N	Y	Y	Y	Y	N	Y	Y	**75.0/L**
Carrard et al. (2018)	Y	Y	Y	Y	Y	N	Y	Y	**87.5/L**

Deshpande et al. (2019)	Y	Y	Y	Y	N	NA	Y	Y	**85.7/L**
Fonseca et al. (2021)	Y	Y	Y	Y	U	N	Y	Y	**75.0/L**
Giudice et al. (2020)	Y	Y	Y	Y	N	NA	Y	Y	**85.7/L**
Gomes et al. (2017)	Y	Y	Y	Y	Y	N	Y	Y	**87.5/L**
Haron et al. (2020)	Y	Y	Y	Y	N	NA	Y	Y	**85.7/L**
Khan et al. (2019)	Y	N	Y	Y	Y	Y	Y	Y	**87.5/L**
Koparal et al. (2019)	Y	Y	Y	N	N	NA	N	N	**42.9/H**
Kovalski et al. (2019)	Y	Y	Y	Y	N	NA	Y	Y	**42.9/H**
Lin et al. (2021)	Y	N	Y	Y	Y	U	U	Y	**62.5/M**
Leão & Porter (1999)	Y	Y	Y	Y	N	NA	Y	Y	**42.9/H**
Perdoncini et al. (2021)	Y	Y	Y	Y	Y	N	Y	Y	**87.5/L**
Petruzzi & De Benedittis (2016)	N	Y	Y	Y	NA	NA	Y	Y	**50.0/M**
Ramesh et al. (2022)	N	Y	Y	Y	U	U	Y	Y	**62.5/M**
Roxo-Gonçalves et al. (2017)	Y	Y	Y	Y	Y	N	Y	Y	**87.5/L**
Subramanian et al. (2021)	Y	Y	Y	Y	N	N	Y	Y	**75.0/L**
Shekar et al. (2018)	Y	N	Y	Y	Y	Y	Y	Y	**87.5/L**

Song et al. (2021)	Y	N	Y	Y	Y	Y	Y	Y	**87.5/L**
Tesfalul et al. (2013)	y	Y	Y	Y	Y	N	Y	N	**75.0/H**
Tesfalul et al. (2016)	Y	Y	Y	Y	N	NA	Y	Y	**85.7/L**
Uthoff et al. (2018)	Y	Y	Y	Y	Y	N	Y	Y	**87.5/L**
Velázquez et al. (2018)	Y	N	U	U	U	U	U	N	**62.5/M**
Vinayagamoorthy et al. (2019)	Y	N	Y	Y	N	N	N	Y	**50.0/M**

Q1. Were the criteria for inclusion in the sample clearly defined? Q2. Were the study subjects and the setting described in detail? Q3. Was the exposure measured in a valid and reliable way? Q4. Were objective, standard criteria used for measurement of the condition? Q5. Were confounding factors identified? Q6. Were strategies to deal with confounding factors stated? Q7. Were the outcomes measured in a valid and reliable way? Q8. Was appropriate statistical analysis used?

B. Checklist for diagnostic test accuracy studies

Author (Year)	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**% /Risk**
Haron et al. (2021)	Y	Y	U	Y	NA	Y	Y	Y	Y	N	**77.8/L**
Torres-Pereira et al. (2008)	N	Y	Y	Y	NA	Y	Y	Y	Y	Y	**88.9/L**
Torres-Pereira et al. (2013)	N	Y	U	Y	NA	Y	Y	Y	Y	Y	**77.8/L**

Q1. Was a consecutive or random sample of patients enrolled? Q2. Was a case control design avoided? Q3. Did the study avoid inappropriate exclusions? Q4. Were the index test results interpreted without knowledge of the results of the reference standard? Q5. If a threshold was used, was it pre-specified? Q6. Is the reference standard likely to correctly classify the target condition? Q7. Were the reference standard results interpreted without knowledge of the results of the index test? Q8. Was there an appropriate interval between index test and reference standard? Q9. Did all patients receive the same reference standard? Q10. Were all patients included in the analysis?

C. Checklist for Quasi-Experimental Studies (non-randomized experimental studies)

Author (Year)	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**% /Risk**
Wang et al. (2020)	Y	Y	Y	Y	N	Y	Y	Y	Y	**88.9/L**
Tovio-Martínez et al. (2020)	Y	Y	Y	Y	Y	U	Y	Y	Y	**88.9/L**
Song et al. (2018)	Y	N	N	N	N	N	Y	Y	Y	**44.4/H**

Q1. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)? Q2. Were the participants included in any comparisons similar? Q3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest? Q4. Was there a control group? Q5. Were there multiple measurements of the outcome both pre- and post- the intervention/exposure? Q6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed? Q7. the outcomes of participants included in any comparisons measured in the same way? Q8. Were outcomes measured in a reliable way? Q9. Was appropriate statistical analysis used?

D. Checklist for Case Reports

Author (Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	% /Risk
Uthoff et al., (2019)	Y	Y	Y	Y	Y	Y	Y	Y	**100.0/L**

Q1. Were technology tool characteristics clearly described? Q2. Was the technology clearly described and presented as a timeline? Q3. Was the current condition of the presentation e tool clearly described? Q4. Were assessment methods and the results clearly described? Q5. Was the intervention(s) or treatment procedure(s) clearly described? Q6. Was the post-intervention clinical condition clearly described? Q7. Were adverse events (harms) or unanticipated events identified and described? Q8. Does the case report provide takeaway lessons?

E. Checklist for Qualitative Research

Author (Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	% /Risk
Falkman et al. (2008)	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	**90.0/L**

Q1. Is there congruity between the stated philosophical perspective and the research methodology? Q2. Is there congruity between the research methodology and the research question or objectives? Q3. Is there congruity between the research methodology and the methods used to collect data? Q4. Is there congruity between the research methodology and the representation and analysis of data? Q5. Is there congruity between the research methodology and the interpretation of results? Q6. Is there a statement locating the researcher culturally or theoretically? Q7. Is the influence of the researcher on the research, and vice- versa, addressed? Q8. Are participants, and their voices, adequately represented? Q9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body? Q10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?

F. Checklist for Cohort Studies

Author (Year)	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**% /Risk**
Desai et al. (2015)	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	**63.6/M**

Q1. Were the two groups similar and recruited from the same population? Q2. Were the exposures measured similarly to assign people to both exposed and unexposed groups? Q3. Was the exposure measured in a valid and reliable way? Q4. Were confounding factors identified? Q5. Were strategies to deal with confounding factors stated? Q6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)? Q7. Were the outcomes measured in a valid and reliable way? Q8. Was the follow up time reported and sufficient to be long enough for outcomes to occur? Q9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored? Q10. Were strategies to address incomplete follow up utilized? Q11. Was appropriate statistical analysis used?

G. Checklist for Randomized Controlled Trials

Author (Year)	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q11**	**Q12**	**% /Risk**
Nayak et al. (2018)	Y	Y	Y	NA	N	N	Y	Y	Y	Y	Y	Y	Y	**83.3/L**

Q1. Was true randomization used for assignment of participants to treatment groups? Q2. Was allocation to treatment groups concealed? Q3. Were treatment groups similar at the baseline? Q4. Were participants blind to treatment assignment? Q5. Were those delivering treatment blind to treatment assignment? Q6. Were outcomes assessors blind to treatment assignment? Q7. Were treatment groups treated identically other than the intervention of interest? Q8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed? Q9. Were participants analyzed in the groups to which they were randomized? Q10. Were outcomes measured in the same way for treatment groups? Q11. Were outcomes measured in a reliable way? Q12. Was appropriate statistical analysis used? Q13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

Reference list for Supplementary Informations A

[1] Aguilar Padrón Ida Vanessa, Lazo Herrera Luis Alberto, Capote Marimón Carolina, Marimón Torres María E. Multimedia MEDICINA BUCAL como complemento educativo para estudiantes de tercer año de Estomatología. RCIM [Internet]. 2018 Dic [citado 2020 Nov 27]; 10(2): e13. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S168418592018000200013&lng=es.

[2] Al-Rawi W, Easterling L, Edwards PC. Development of a mobile device optimized cross platform-compatible oral pathology and radiology spaced repetition system for dental education. J Dent Educ. 2015;79(4):439-447.

[3] Anantharaman R, Anantharaman V and Lee Y, "Oro Vision: Deep Learning for Classifying Orofacial Diseases." 2017; IEEE International Conference on Healthcare Informatics (ICHI), Park City, UT. 2017; 39-45. doi: 10.1109/ICHI.2017.69.

[4] Bhatt S, Isaac R, Finkel M, et al. Mobile technology and cancer screening: Lessons from rural India. J Glob Health. 2018;8(2):020421. doi:10.7189/jogh.08.020421

[5] Birur PN, Sunny SP, Jena S, et al. Mobile health application for remote oral cancer surveillance. J Am Dent Assoc. 2015;146(12):886-894. doi:10.1016/j.adaj.2015.05.020.

[6] Birur NP, Patrick S, Bajaj S, et al. A Novel Mobile Health Approach to Early Diagnosis of Oral Cancer. J Contemp Dent Pract. 2018;19(9):1122-1128. Published 2018 Sep 1.

[7] Birur NP, Gurushanth K, Patrick S, Sunny SP, Raghavan SA, Gurudath S, Hegde U, Tiwari V, Jain V, Imran M, Rao P, Kuriakose MA. Role of community health worker in a mobile health program for early detection of oral cancer. Indian J Cancer. 2019 Apr-Jun;56(2):107-113. doi: 10.4103/ijc.IJC_232_18. PMID: 31062727.

[8] Bradley M, Black P, Noble S, Thompson R, Lamey PJ. Application of teledentistry in oral medicine in a community dental service, N. Ireland. Br Dent J. 2010 Oct 23;209(8):399-404. doi: 10.1038/sj.bdj.2010.928. PMID: 20966999.

[9] Carrard VC, Roxo Gonçalves M, Rodriguez Strey J, et al. Telediagnosis of oral lesions in primary care: The EstomatoNet Program. Oral Dis. 2018;24(6):1012-1019. doi:10.1111/odi.12851.

[10] Desai R, Birur P, Bajaj S, et al. Smokeless Tobacco-associated Lesions: A Mobile Health Approach. J Contemp Dent Pract. 2015;16(10):813-818. Published 2015 Oct 1. doi:10.5005/jp-journals-10024-1762.

[11] Deshpande S, Radke U, Karemore T, Mohril R, Rawlani S, Ingole P. A Novel Mobile App for Oral Cancer Awareness amongst General Population: Development, Implementation, and Evaluation. J Contemp Dent Pract. 2019;20(2):190-196. Published 2019 Feb 1.

[12] Falkman G, Gustafsson M, Jontell M, Torgersson O. SOMWeb: a semantic web-based system for supporting collaboration of distributed medical communities of practice. J Med Internet Res. 2008;10(3):e25. Published 2008 Aug 26. doi:10.2196/jmir.1059.

[13] Giudice A, Barone S, Muraca D, et al. Can Teledentistry Improve the Monitoring of Patients during the Covid-19 Dissemination? A Descriptive Pilot Study. Int J Environ Res Public Health. 2020;17(10):3399. Published 2020 May 13. doi:10.3390/ijerph17103399.

[14] Gomes MS, Bonan PR, Ferreira VY, de Lucena Pereira L, Correia RJ, da Silva Teixeira HB, Pereira DC, Bonan P. Development of a mobile application for oral cancer screening. Technol Health Care. 2017;25(2):187-195. doi: 10.3233/THC-161259.

[15] Haron N, Zain RB, Ramanathan A, et al. m-Health for Early Detection of Oral Cancer in Low- and Middle-Income Countries. Telemed J E Health. 2020;26(3):278-285. doi:10.1089/tmj.2018.0285.

[16] Khan S, Hussain MAB, Khan AP, et al. Clinical evaluation of smartphone-based fluorescence imaging for guidance and monitoring of ALA-PDT treatment of early oral cancer. J Biomed Opt. 2020;25(6):1-10. doi:10.1117/1.JBO.25.6.063813.

[17] Koparal M, Ünsal HY, Alan H, Üçkardeş F, Gülsün B. WhatsApp messaging improves communication in an oral and maxillofacial surgery team. Int J Med Inform. 2019;132:103987. doi:10.1016/j.ijmedinf.2019.103987.

[18] Kovalski LNS, Cardoso FB, D'Avila OP, et al. Is the YouTube™ an useful source of information on oral leukoplakia?. Oral Dis. 2019;25(8):1897-1905. doi:10.1111/odi.13161.

[19] Leao JC, Porter SR. Telediagnosis of oral disease. Braz Dent J. 1999;10(1):47-53.

[20] Nayak PP, Nayak SS, Sathiyabalan D, Aditya NK, Das P. Assessing the Feasibility and Effectiveness of an App in Improving Knowledge on Oral Cancer-an Interventional Study. J Cancer Educ. 2018;33(6):1250-1254. doi:10.1007/s13187-017-1239-y.

[21] Petruzzi M, De Benedittis M. WhatsApp: a telemedicine platform for facilitating remote oral medicine consultation and improving clinical examinations. Oral Surg Oral Med Oral Pathol Oral Radiol. 2016;121(3):248-254. doi:10.1016/j.oooo.2015.11.005.

[22] Roxo-Gonçalves M, Strey JR, Bavaresco CS, et al. Teledentistry: A Tool to Promote Continuing Education Actions on Oral Medicine for Primary Healthcare Professionals. Telemed J E Health. 2017;23(4):327-333. doi:10.1089/tmj.2016.0101.

[23] Shekar R, George BC, Bohnen JD, Villa A. A SIMPL application to assess oral medicine residents' performance and level of autonomy. Oral Surg Oral Med Oral Pathol Oral Radiol. 2018;126(3):246-251. doi:10.1016/j.oooo.2018.05.017.

[24] Song B, Sunny S, Uthoff RD, et al. Automatic classification of dual-modalilty, smartphone-based oral dysplasia and malignancy images using deep learning. Biomed Opt Express. 2018;9(11):5318-5329. Published 2018 Oct 10. doi:10.1364/BOE.9.005318.

[25] Tesfalul M, Littman-Quinn R, Antwi C, et al. Evaluating the impact of a mobile oral telemedicine system on medical management and clinical outcomes of patients with complicated oral lesions in Botswana. Stud Health Technol Inform. 2013;192:1074.

[26] Tesfalul M, Littman-Quinn R, Antwi C, et al. Evaluating the potential impact of a mobile telemedicine system on coordination of specialty care for patients with complicated oral lesions in Botswana. J Am Med Inform Assoc. 2016;23(e1):e142-e145. doi:10.1093/jamia/ocv140

[27] Torres-Pereira CC, Morosini Ide A, Possebon RS, et al. Teledentistry: distant diagnosis of oral disease using e-mails. Telemed J E Health. 2013;19(2):117-121. doi:10.1089/tmj.2012.0087.

[28] Torres-Pereira C, Possebon RS, Simões A, et al. Email for distance diagnosis of oral diseases: a preliminary study of teledentistry. J Telemed Telecare. 2008;14(8):435-438. doi:10.1258/jtt.2008.080510.

[29] Tovio-Martínez Eilien, Carmona-Lordouy Martha, Harris Jonathan, Guzmán Eliana. Aplicación móvil para la enseñanza de lesiones elementales en cavidad bucal. Univ. Salud [Internet]. 2020 Apr [cited 2020 Nov 27] ; 22(1): 70-76. Available from: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124710720200001000 70&lng=en. http://dx.doi.org/10.22267/rus.202201.176.

[30] Uthoff RD, Song B, Sunny S, et al. Point-of-care, smartphone-based, dual-modality, dual-view, oral cancer screening device with neural network classification for low-resource communities. PLoS One. 2018;13(12):e0207493. Published 2018 Dec 5. doi:10.1371/journal.pone.0207493.

[31] Uthoff RD, Song B, Sunny S, et al. Small form factor, flexible, dual-modality handheld probe for smartphone-based, point-of-care oral and oropharyngeal cancer screening. J Biomed Opt. 2019;24(10):1-8. doi:10.1117/1.JBO.24.10.106003.

[32] Santos Velázquez Taimi, Vega Rodríguez Elsa, Peña Vega Ana Elsa. Software educativo Elementos de Nutrident para el proceso enseñanza aprendizaje en Estomatología. Rev Ciencias Médicas [Internet]. 2018 Dic [citado 2020 Nov 27] ; 22(6): 114-122. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1561-31942018000600114&lng=es.

[33] Vinayagamoorthy K, Acharya S, Kumar M, Pentapati KC, Acharya S. Efficacy of a remote screening model for oral potentially malignant disorders using a free messaging application: A diagnostic test for accuracy study. Aust J Rural Health. 2019;27(2):170-176. doi:10.1111/ajr.12496.

[34] Wang ZC, Zhang SP, Yuen PC, et al. Intra-Rater and Inter-Rater Reliability of Tongue Coating Diagnosis in Traditional Chinese Medicine Using Smartphones: Quasi-Delphi Study. JMIR Mhealth Uhealth. 2020;8(7):e16018. Published 2020 Jul 9. doi:10.2196/16018.

[35] Lin H, Chen H, Weng L, Shao J, Lin J. Automatic detection of oral cancer in smartphone-based images using deep learning for early diagnosis. J Biomed Opt. 2021;26(8):086007. doi: 10.1117/1.JBO.26.8.086007.

[36] Song B, Sunny S, Li S, Gurushanth K, Mendonca P, Mukhia N, et al. Mobile-based oral cancer classification for point-of-care screening. J Biomed Opt. 2021;26(6):065003. doi: 10.1117/1.JBO.26.6.065003.

[37] Subramanian S, Jose R, Lal A, Augustine P, Jones M, Gopal BK, et al. Acceptability, Utility, and Cost of a Mobile Health Cancer Screening Education Application for Training Primary Care Physicians in India. Oncologist. 2021;26(12):e2192-e2199. doi: 10.1002/onco.13904.

[38] Haron N, Rajendran S, Kallarakkal TG, Zain RB, Ramanathan A, Abraham MT, et al. High referral accuracy for oral cancers and oral potentially malignant disorders using telemedicine. Oral Dis. 2021. doi: 10.1111/odi.13892. Epub ahead of print.

[39] Ramesh RM, Patrick S, Lotha Z, Azole, Aier A, Birur N P. Prevalence and determinants of oral potentially malignant lesions using mobile health in a rural block, northeast India. Trop Doct. 2022;52(1):53-60. doi: 10.1177/00494755211049973.

[40] Fonseca BB, Perdoncini NN, da Silva VC, Gueiros LAM, Carrard VC, Lemos CA Jr, Schussel JL, Amenábar JM, Torres-Pereira CC. Telediagnosis of oral lesions using smartphone photography. Oral Dis. 2021. doi: 10.1111/odi.13972. Epub ahead of print.

[41] Perdoncini NN, Schussel JL, Amenábar JM, Torres-Pereira CC. Use of smartphone video calls in the diagnosis of oral lesions: Teleconsultations between a specialist and patients assisted by a general dentist. J Am Dent Assoc. 2021;152(2):127-135. doi: 10.1016/j.adaj.2020.10.013.

5 CONSIDERAÇÕES FINAIS

Apesar dos avanços nos serviços de saúde bucal e educação odontológica, no Brasil, assim como em outros países em desenvolvimento, ainda existem muitas lacunas no acesso e na qualidade desses serviços. A respeito da educação odontológica, com o desenvolvimento da tecnologia, a Internet tornou-se uma fonte de informação muito popular. Entretanto, a qualidade e a evidência científica das informações relacionadas à saúde bucal na Internet são variáveis. Considerando que a informação publicada nessa mídia não está sujeita a nenhum mecanismo de controle, a sua confiabilidade é da responsabilidade dos remetentes. Essa situação na área médica e odontológica tornou-se motivo de preocupação e alerta para comunidade científica, considerando que informações errôneas e úteis podem ser disponibilizadas na mesma velocidade. Nesse sentido, devido ao seu acesso gratuito e fácil, o uso do YouTube™ como fonte de informação para estudantes, profissionais de saúde e público leigo tem se expandido nos últimos anos e tópicos relacionados à odontologia têm sido investigados com menos frequência quando comparados à área médica. Em vista dos nossos resultados, observou-se uma oportunidade em meio a necessidade de difundir conteúdo odontológico baseado nas melhores e mais atuais evidências disponíveis por meio de instituições oficialmente reconhecidas, como o TelessaúdeRS-UFRGS. Isto pode favorecer o ensino de estudantes de odontologia, educação continuada para os dentistas e o público externo que procura por informações relacionadas à odontologia.

Adicionalmente, diante da revisão da literatura sobre ferramentas tecnológicas de suporte à estomatologia, foi possível constatar que o diagnóstico, incluindo o diagnóstico precoce do câncer de boca e o manejo das lesões bucais, é dificultado pela falta de treinamento prático, e muitas vezes de conhecimento de dentistas não especialistas na área de estomatologia. Nesse sentido, o uso de aplicativos, mídias sociais, plataformas e tecnologias como inteligência artificial direcionadas à estomatologia são alternativas para dar suporte aos profissionais de saúde no que diz respeito ao diagnóstico e manejo de lesões bucais. Além desses benefícios, destaca-se que o uso dessas ferramentas pode evitar encaminhamentos desnecessários para demais níveis

de atenção. Uma vez que doenças bucais mais comuns podem ter seu tratamento na atenção primária com a orientação do consultor especializado, os casos com suspeita de malignidade podem ter algum potencial para encaminhamento de forma mais ágil aos serviços especializados, e nesse sentido, sugerimos esforços de pesquisas futuras. Esse fato pode potencialmente impactar no diagnóstico precoce de câncer bucal para a redução de morbidade e consequentemente de mortalidade.

Contudo, sabe-se que a pandemia da COVID-19 decretada em 11 de março de 2020, trouxe prejuízos imensuráveis. Não obstante, alguns benefícios em termos de avanço tecnológico em prol da tentativa de minimizar os danos a saúde e a educação foram um grande destaque. E interessantemente, com base nos resultados desse estudo, a maioria dessas tecnologias tem potencial para serem mantidas após esse período, considerando a acessibilidade aos serviços de saúde bucal, especificamente na estomatologia, na qualidade da assistência prestada e no aprimoramento da educação odontológica por meio de plataformas como o YouTube™. Nesse sentido, ressaltamos para futuros estudos o aprimoramento e a difusão dessas ferramentas de suporte à estomatologia, visando maiores benefícios em termos de prognóstico, custos e qualidade de vida pela perspectiva também dos pacientes. Assim, essas ferramentas em âmbitos de diagnóstico e/ou educação podem impactar positivamente em termos de saúde pública e economia.

REFERÊNCIAS

APELIAN, N.; VERGNES, J.N.; BEDOS, C. Is the dental profession ready for person-centred care? **Br Dent J,** London, v. 229, n. 2, p.133-137, 2020.

BIRUR, N. P. *et al*. A Novel Mobile Health Approach to Early Diagnosis of Oral Cancer. **J Contemp Dent Pract**, Cincinnati, v. 19, n. 9, p. 1122-1128, 2018.

DIAS DA SILVA, M. A.; PEREIRA, A. C.; WALMSLEY, A. D. Who is providing dental education content via YouTube? **British dental journal**, London, v. 226, n. 6, p. 437-440, 2019.

DIAS DA SILVA, M. A.; WALMSLEY A. D. Fake news and dental education. **British dental journal**, London, v. 226, n. 6, p. 397-399, 2019.

DUNCAN, I.; YARWOOD-ROSS, L.; HAIGH, L. YouTube as a source of clinical skills education. **Nurse Education Today**, Edinburgh, v. 33, n. 12, p. 1576-1580, 2013.

FAT, M. J. *et al*. YouTube videos as a teaching too l and patient resource for infantile spasms. **Journal of Child Neurology**, Littleton, v. 26, n. 7, p. 804-809, 2011.

FORTUNA, G. *et al*. The usefulness of YouTube™ videos as a source of information on burning mouth syndrome. **Journal of oral rehabilitation,** Oxford, v. 46, n.7, p. 657-665, 2019.

GIUDICE, A. *et al*. Can Teledentistry Improve the Monitoring of Patients during the Covid-19 Dissemination? A Descriptive Pilot Study. **Int J Environ Res Public Health**, Basel, v. 17, n. 10, p. 3399, 2020.

HARZHEIM, E. *et al*. Telehealth in Rio Grande do Sul, Brazil: Bridging the gaps. **Telemed e-Health**, Larchmont v. 22, n. 11, p. 938-44, 2016.

HOLLINDERBÄUMER, A.; HARTZ, T.; UCKERT, F. Education 2.0 -- how has social media and Web 2.0 been integrated into medical education? A systematical literature review. **GMS Zeitschrift für medizinische Ausbildung**, Erlangen**,** v. 30, n.1, p. 14, 2013.

KATA, A. Anti-vaccine activists, Web 2.0, and the postmodern paradigm – An overview of tactics and tropes used online by the anti-vaccination movement. **Vaccine**, Guildford, v. 30, n. 25, p. 3778-3789, 2012.

KNÖSEL, M.; JUNG, K.; BLECKMANN, A. YouTube, dentistry, and dental education. **Journal of dental education**, Washington, v. 75, n. 12, p. 1558-68, 2011.

KOVALSKI, L. N. S. *et al*. Is the YouTube™ an useful source of information on oral leukoplakia? **Oral Diseases**, Houndmills, v. 25, n.8, p. 1897-1905, 2019.

LI, T. Y. *et al*. Learning Clinical Procedures Through Internet Digital Objects: Experience of Undergraduate Students Across Clinical Faculties. **Journal of medical internet research**, Toronto, v. 14, n.1, p. e1, 2015.

LÓPEZ-JORNET, P.; PONS-FUSTER, E.; RUIZ-ROCA, J.A. YouTube videos on oral care of the organ or hematopoietic stem cell transplant patients. **Support Care Cancer**, Berlin, v. 25, n. 4, p. 1097-1101, 2017.

LÓPEZ JORNET, P. *et al*. Attitude towards oral biopsy among general dentists in Murcia. **Med Oral Patol Oral Cir Bucal**, Valencia, v. 12, n. 2, p. E116-21, 2007.

PASSOS, K.K. *et al*. "Quality of information about oral cancer in Brazilian Portuguese available on Google, Youtube, and Instagram. **Medicina oral, patologia oral y cirugia bucal**, Valencia, vol. 25, n. 3, p. e346-e352, 2020.

RAMOS-RINCÓN, J. M. *et al*. The reach of Spanish-language YouTube videos on physical examinations made by undergraduate medical students. **Journal of educational evaluation for health professions**, Seoul, v. 19, n. 14, p. 31, 2017.

RAZAVI, S. M. *et al*. Dentists' knowledge, attitude, and practice regarding oral cancer in Iran. **J Cancer Educ,** New York, v. 28, n. 2, p.3 35-41, 2013.

SADEGHI, R.; HESHMATI, H. Innovative methods in teaching college health education course: A systematic review. **Journal of education and health promotion**, Mumbai, v. 14, n.8, p. 103, 2019.

SEO, C. W. *et al*. Dental students' learning attitudes and perceptions of YouTubeTM as a lecture video hosting platform in a flipped classroom in Korea. **Journal of educational evaluation for health professions**, Seoul, v. 15, n. 24, 2018.

SILVA, F. R. *et al*. The visibility and coverage of Primary Health Care videos posted by the nucleous of telehealth and telemedicine, Federal University of Rio Grande do Sul on YouTube™ between 2012 and 2014. In: CONGRESSO BRASILEIRO DE TELEMEDICINA E TELESSAÚDE. **Jornal Brasileiro de Telessaúde**, Rio de Janeiro, v. 4, n. 1, p. 151-152, 2016.

STREY, J. R. *et al*. Oral Medicine Experience and Attitudes Toward Oral Cancer: An Evaluation of Dentists Working in Primary Health Care. **J Cancer Educ,** New York, 2021. [Epub ahead of print].

TUELLS, J. *et al*. Características de los vídeos en español publicados en YouTube sobre la vacuna contra el virus del papiloma humano. **Revista Española de Salud Pública,** Madrid, v. 89, n. 1, p.107-115, 2015.

TURKYILMAZ, I.; HARIRI, N.H.; JAHANGIRI, L. Student's Perception of the Impact of E-learning on Dental Education. **The journal of contemporary dental practice**, Cincinnati, v. 20, n. 5, p. 616-621, 2019.

YÜCE, M.Ö.; ADALI, E.; KANMAZ, B. An analysis of Youtube videos as educational resources for dental practitioners to prevent the spread of COVID-19. **Ir J Med Sci**, Dublin, v. 190, n. 1, p.19-26, 2021.