

Social Messaging Apps as Oral Health Promotion Tools: A Literature Review

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Abstract

Social messaging apps are now integral to daily life, transforming communication and information sharing. These platforms show potential as tools for health promotion. However, existing studies vary in scope, outcomes, and platforms, leading to inconsistencies in assessing the impact and effectiveness of oral health (OH) promotion. This review aims to examine the type of social messaging apps used for OH promotion and their impact on OH knowledge, attitude, behavior, and OH status. The search was conducted across four electronic databases using relevant keywords to identify articles published between 2004 and 2024. This review includes experimental and quasi-experimental study designs, published in the English language. Data such as the study design and the characteristics of social messaging apps for OH promotion and their effect on knowledge, attitude, behavior, and OH status were extracted. The systematic search identified 601 articles, with 15 studies being included in the analysis. Four studies reported on OH knowledge and behavior outcomes, six reported on OH status outcomes, and five reported a combination of both outcomes. WhatsApp was the most utilized social media platform reported in these studies. OH promotion interventions leveraging these platforms demonstrated significant improvements in OH knowledge and status, particularly when using customizable, engaging content supported by continuous information delivery. However, more robust primary studies investigating specific tools, engagement strategies, user preferences, and patterns of patient interaction can offer substantial benefits to patient health, in line with technological adoption.

Keywords: messaging apps, mobile application, oral health, oral health promotion

Introduction

Oral diseases persist as a significant public health burden globally, impacting populations across nations despite advancements in technology. The Global Burden of Disease Study identified oral pathologies as the most widespread and impactful condition worldwide from a public health perspective.⁽¹⁾ Dental caries and periodontal disease remain prevalent among the adult population globally and are frequently associated with pain, discomfort, and early tooth loss.^(1,2)

Historically, oral health (OH) promotion relied on traditional methods, including brochures, posters, OH talks, exhibition booths and community outreach programs.⁽³⁾ The digital revolution, however, has led to a more innovative and dynamic approach through the use of social media and messaging apps, which have become ubiquitous in the lives of the younger generation, thus offering opportunities to leverage these platforms for health promotion.⁽⁴⁾ Social media consumers also perceived the benefits of using social media as being easily available, in addition to increasing their awareness, providing online support, and helping them conform to current informational norms.^(5,6)

Although several studies have investigated social media and mobile applications for OH promotion, there is considerable variations in terms of the scope, outcome, and platform involved.⁽⁷⁻⁹⁾ A previous systematic review examined broad social media platforms for OH promotion but had limited focus on messaging apps and outcomes related to OH attitudes and behaviors.⁽⁷⁾ Furthermore, considering the contemporary and evolving nature of existing social and messaging apps platforms, each with unique features, there is a need to synthesize the evidence related to specific platforms. Synthesizing this evidence would enhance understanding of OH promotion initiatives that employ these specific messaging apps technologies. Therefore, this literature review aims to synthesize existing evidence on the use of social messaging apps for OH promotion by identifying the types of apps used and examining their reported impact on improving OH knowledge, attitudes, behaviors, and OH status.

Materials and Methods

Search strategy

A systematic search was conducted across four databases (PubMed, Scopus, Web of Science, and Medline)

using a combination of search terms for social messaging apps, oral health promotion, and oral health impacts to address the research objectives. Boolean search methods such as “AND” and “OR” were used to find relevant articles. Example of search strategies include ("social networking" OR "instant messaging" OR "messenger" OR "chat" OR Snapchat OR WeChat OR WhatsApp OR Telegram) AND ("oral health education" OR "oral health promotion" OR "oral health information") AND ("oral health literacy" OR "oral health knowledge" OR "oral health attitude" OR "oral health behaviours" OR "oral health practice" OR "oral hygiene") AND ("young adult" OR adolescent OR adulthood OR youth OR "college student"). Database-controlled vocabulary was used to search subject headings, with relevant synonyms being utilized for searching titles, abstracts, and keywords. The search was limited to English publications from 2004 to Dec 2023 and an updated search was conducted until March 2024. The search results were then exported into the Rayyan web application (<http://rayyan.qcri.org>) to further assist in the screening process and removal of duplicates.

Selection process

Two reviewers screened and analyzed the titles and abstracts from the list of electronic searches using a screening form based on the inclusion and exclusion criteria. The inclusion criteria are as follows: (1) studies involving social messaging apps for OH promotion; (2) studies with OH knowledge, attitude, behavior, and OH status based on clinical indicators; (3) experimental and quasi-experimental study designs; (4) peer-reviewed journal articles. The exclusion criteria are as follows: (1) studies of social messaging apps for surveillance/mediators; (2) editorial, case report, book chapter, literature review, and consensus; (3) studies of training or personal development using social messaging apps; (4) studies of social messaging apps as recruitment tools; (5) studies involving specific mobile health application.

Data extraction

Data were extracted by the first reviewer and verified by the second reviewer using a standardized data extraction form. The extracted information included general study characteristics (author, country, year, study design, and target group), study duration, types of social

messaging apps, OH promotion methods, and KAB or OH status outcomes (Table 1). Any discrepancies were resolved through discussion with a third reviewer.

Results

Literature identified from the search

A total of 601 articles were identified through electronic database searches. Of the total, 106 duplicate articles were removed, and 495 articles underwent screening based on their titles and abstracts. Among these, 431 articles were considered irrelevant and consequently removed, resulting in 64 articles retrieved for their full-text review. Subsequently, another 49 articles were excluded, resulting in 15 articles eligible for data extraction and analysis.

Characteristics of included articles

A total of fifteen studies were included for analysis. These studies originated from twelve countries spanning from Asia, the Middle East, Europe, and South America. The most common studies are from Saudi Arabia (n=4), India (n=3), Malaysia (n=2), and China (n=2). Single studies were conducted in Italy, Thailand, Brazil, and Iran. In terms of the study design, most of the studies utilized randomized controlled trials (n=12). Specifically, there were six randomized controlled trials⁽¹⁰⁻¹⁵⁾, three single-blinded randomized controlled trials⁽¹⁶⁻¹⁸⁾, two non-blinded randomized control trials⁽¹⁹⁻²⁰⁾, and one double-blinded randomized controlled trial.⁽²¹⁾ The remaining three studies were quasi-experimental designs.⁽²²⁻²⁴⁾

Four studies evaluated outcomes solely in terms of self-reported improvements in OH knowledge, attitudes, and behaviors.^(12,22,23) Meanwhile, six studies reported quantifiable OH status using clinical parameters (i.e., gingival status, dental plaque, caries free) as primary outcomes.^(11,14,15,17,19,21) The remaining five studies assessed a combination of variables on OH knowledge, attitudes, and behaviors as well as OH status as study outcomes.^(13,18,20,23,24) The characteristics of included studies are summarized in Table 1.

Characteristics of social messaging apps used

The most popular social messaging intervention was delivered using WhatsApp (n=9). On the contrary, Telegram was used as an intervention in two studies, similar

to the WeChat application.^(10,17) A single study utilized Snapchat⁽¹⁶⁾ and Chatbot Messenger.⁽²⁴⁾

The included studies identified several OH promotion activities using social messaging applications. Most of the studies utilized social messaging apps to deliver educational and motivational content (n=8). Three studies employed these apps to send reminders to practice oral hygiene, while one study provided support to encourage self-monitoring of OH behavior. The remaining three studies combined multiple OH promotion activities delivered through social messaging apps (Table 2).

These various activities share common characteristics: 1) providing tailored and personalized educational materials, 2) offering interactive and engaging content, and 3) providing continuous information and support to participants. Firstly, tailored OH promotion delivered via social messaging apps effective on specific user groups such as parents/caregivers⁽²³⁾, patients⁽¹⁵⁾, students⁽¹³⁾, and pregnant women⁽¹⁶⁾ to improve their oral hygiene and gingival health.

Secondly, social messaging apps enable experts to disseminate visually interactive content like videos and infographics to educate audiences and promote OH behaviors.^(18,23) For example, delivering infographic-based information through WhatsApp to orthodontic patients as opposed to providing the same information through plain text messages.⁽¹¹⁾ Moreover, social messaging enables audio narration to complement the information delivered for better comprehension.⁽¹⁸⁾ Additionally, social messaging platforms permit discussions between patients and OH providers in order to exchange condition-specific information, advice, and treatment recommendations.⁽¹²⁾

Finally, this platform also allows ongoing informational and social support delivery for the intended audiences. For instance, regular reminders and OH notifications delivered to patients over social messaging apps provide a consistent flow of information to address the needs and demands of the target populations.^(13,15,17,18)

Impact of social messaging app interventions on knowledge, attitude, and behaviors

Two studies of college students demonstrated that social messaging apps have significantly improved oral cancer knowledge and promoted further online discussions compared to conventional audio-visual aids.^(12,13)

Table 1: Summary of the characteristics of included studies (n=15).

Study	Country	Study Design	Sample Size	Outcome Measure
Aboalshamat <i>et al.</i> , 2019	Saudi Arabia	Single-blinded parallel group RCT	68	OH Knowledge • Pregnancy-related OH knowledge
Al Gunaid <i>et al.</i> , 2021	Saudi Arabia	Quasi-experimental	70	OH Knowledge • Orthodontic topics
Al-ak'hali <i>et al.</i> , 2020	Saudi Arabia	Randomised controlled trial	43	OH Status • PI • GI
Borujeni <i>et al.</i> , 2021	Iran	Single-blinded parallel group RCT	60	OH Status • PI • Gingiva colour & consistency
Deghatipour <i>et al.</i> , 2021	Iran	Randomised controlled trial	439	OH Behaviour • Children's OH care behaviour • Children's sweet consumption OH Status • % caries-free children
Li <i>et al.</i> , 2016	China	Non-blinded, two-arm randomised controlled trial	224	OH Behaviour • No failed attendance • Duration of treatment OH Status • PI • MGI
Lotto <i>et al.</i> , 2020	Brazil	Single-blinded, 2-parallel arm, randomised controlled trial	104	OH Knowledge • Parental eHealth literacy • Children's sugar-free sweets consumption OH Status • % caries free lesion
Malik <i>et al.</i> , 2019	India	Randomised controlled trial	34	OH Status • PI • MGI • BI
Mustafa <i>et al.</i> , 2022	Malaysia	Quasi-experimental	123	OH Behaviour • Children's oral care
Nayak P <i>et al.</i> , 2018	India	Cluster randomised controlled trial	182	OH Knowledge • Tobacco • Oral cancer
Pithpornchaiyakul <i>et al.</i> , 2022	Thailand	Quasi-experimental	71	OH Knowledge • Toothbrushing information OH Behaviour • Toothbrushing frequency
Saxena & Gunja, 2022	Malaysia	Double-blinded parallel group RCT	54	OH Status • Mean plaque scores
Subburaman <i>et al.</i> , 2021	India	Randomised interventional study	140	OH Knowledge • KAB score OH Status • PI • OHI • MGI
Wu <i>et al.</i> , 2022	China	Non-blinded randomised controlled trial	44	OH Status • PI • BOMP
Zotti <i>et al.</i> , 2019	Italy	Randomised controlled trial	60	OH Status • Changes in intercanine width OH Behaviour • Compliance with orthodontic treatment

BI: bleeding index; BOP: bleeding on probing; BOMP: bleeding on marginal probing index; GI: gingival index; KAB: knowledge, attitudes, behaviour; MGI: modified gingival index; OH: oral health; OHE: oral health education; OHI: oral hygiene instruction; PI: plaque index.

Table 2: Oral health promotion activities identified on social messaging apps.

Oral health promotion activities	References	Number of articles
Deliver educational and motivational content	Aboalshamat <i>et al</i> , 2023 ⁽¹⁶⁾ ; Al-Ak'hali <i>et al</i> , 2020 ⁽¹⁵⁾ ; Al-Gunaid <i>et al</i> , 2021 ⁽²²⁾ ; Borujeni <i>et al</i> , 2021 ⁽¹⁷⁾ ; Deghatipour <i>et al</i> , 2021 ⁽¹⁰⁾ ; Lotto <i>et al</i> , 2020 ⁽¹⁸⁾ ; Mustafa <i>et al</i> , 2022 ⁽²³⁾ ; Subburaman <i>et al</i> , 2021 ⁽¹³⁾	8
Deliver oral hygiene reminders	Li <i>et al</i> , 2016 ⁽²⁰⁾ ; Malik <i>et al</i> , 2019 ⁽¹⁴⁾ ; Saxena and Gunjal, 2021 ⁽²¹⁾	3
Support self-monitoring	Zotti <i>et al</i> , 2019 ⁽¹⁴⁾	1
Multiple activities	Nayak <i>et al</i> , 2018 ⁽¹²⁾ ; Pithpornchaiyakul <i>et al</i> , 2022 ⁽²⁴⁾ ; Wu <i>et al</i> , 2022 ⁽¹⁹⁾	3

Parental intervention via WhatsApp increased OH knowledge and shifted attitudes and behaviors around children's oral health.⁽²³⁾ Additionally, orthodontic patients receiving WhatsApp images, videos, and texts showed substantial gains in OH knowledge.⁽²²⁾ Table 3 shows a summary of the reported OH knowledge, attitude, and behavior (KAB) outcomes.

Impact of social messaging apps intervention on OH status outcomes

WhatsApp reminders and motivation increased oral hygiene compliance among participants.^(11,13) Another study found gradual gains in oral hygiene and gingival health over time. Additionally, WhatsApp reminders with added graphic image on toothbrushing, reduced plaque, gingival bleeding, and inflammation as opposed to plain text messages reminders.⁽¹¹⁾ Tracking active engagement through intraoral photos through WeChat intervention has also strengthened intentions and behaviors beyond passive information consumption among orthodontic patients.^(14,19) The impact of social messaging apps intervention on OH status outcomes is summarized in Table 4.

Impact of social messaging apps on the combination of OH knowledge, attitude, behavior and OH status

Studies reporting a combination of KAB and OH outcomes showed that social messaging interventions boosted parental eHealth literacy and reduced child sugar intake.^(18,23) Meanwhile, a Chatbot messenger intervention targeting parents and caregivers, significantly increased overall OH knowledge and reduced plaque accumulation.⁽²⁴⁾ However, when comparing social messaging app interventions to a more comprehensive mixed approach, a study⁽¹⁰⁾ found that social messaging apps alone resulted in the lowest percentage of caries-free children compared to groups receiving a blended inter-

vention including in-person education and dialogue (Table 5).

Discussion

Since social messaging apps have achieved widespread use and acceptance, they present potential and economical tools for impactful and equitable OH promotion across populations. Compared to conventional brochures, public service announcements, or mass media, social messaging platforms provide a personalized and engaging avenue for healthcare communication.⁽²⁵⁾ For instance, social messaging apps permit consumer-centric content sharing, thus allowing some degree of anonymity or desired personal connection.^(26,27) Furthermore, transforming OH promotion intervention into a more accessible, interactive, and engaging process offers diverse tools for healthcare experts to creatively connect with both patients and the public.⁽²⁷⁾

Recent evidence highlights that messaging apps are increasingly preferred channels for delivering OH information, particularly among adolescents and young adults.⁽⁷⁾ Unlike traditional social media platforms, where lengthy posts are often overlooked, users of messaging apps tend to engage more with concise, visually supported content.^(23,26,27) Kite *et al.*,⁽²⁸⁾ noted that young individuals generally avoid reading comprehensive health materials, suggesting that within messaging environments, health messages must be brief, visually appealing, and supported by images or short videos to sustain attention and encourage information sharing. Photographs, in particular, have been shown to be highly effective for conveying OH information due to their ability to communicate messages quickly and clearly.^(22,23)

In addition, messaging apps allow users to receive content directly and privately, making it easier to blend succinct text with multimedia elements such as images,

Table 3: Social messaging applications and oral health knowledge, attitude, and behavior outcomes.

Reference (Country)	Study design	Study population and sample size	Study duration	Social messaging apps	OH promotion methods	Findings
Aboalshamat <i>et al.</i> , 2019 ⁽¹⁶⁾ (Saudi Arabia)	Single-blinded parallel group RCT	68 pregnant women in Saudi Arabia	2 weeks	Intervention: Snapchat Comparison: Written flyers WhatsApp	Snapchat stories (5-10 minutes video sent twice a week)	No significant differences were found in the scores between groups at all times ($p>0.050$)
Al-Gunaid <i>et al.</i> , 2021 ⁽²²⁾ (Saudi Arabia)	Quasi-experimental	70 members of the public	14 days	Intervention: WhatsApp	Orthodontic-related information being sent to the groups every day	Drastic improvement in patient knowledge from early stage to end-stage, with a significance level of $p<0.01$. All types of media formats (image, video, text) were significantly effective in improving the patients' knowledge ($p<0.001$).
Nayak <i>et al.</i> , 2018 ⁽¹²⁾ (India)	Cluster RCT	182 first- and second-year Bachelor of Commerce students	4 weeks	Intervention: WhatsApp Comparison: Power-Point presentation	WhatsApp messages (pictures and video) were sent daily with a group discussion on the WhatsApp chat room every Saturday A PowerPoint presentation was held twice every week, and at the end of the sessions, queries were answered.	The intervention group showed a statistically significant increase in all knowledge core topics except the etiology of oral cancer ($p=0.280$). The control group showed a significant increase in knowledge scores found in only two core topics; signs of oral cancer ($p<0.001$) and epidemiology of oral cancer ($p<0.001$). A significant difference between knowledge scores post-intervention ($t=-15.05$, $p<0.001$).
Mustafa <i>et al.</i> , 2022 (Malaysia) ⁽²³⁾	Quasi-experimental	123 parents and caregivers of preschool children	5 months	WhatsApp	20 infographics of oral health (based on 10 dental topics) sent 2 weeks	Significant differences in oral and dental care of children before and after the infographics were sent to the respondents ($p<0.001$)

OH: oral health; RCT: randomized controlled trial

Table 4: Social messaging applications and oral health status.

Reference (Country)	Study design	Study population and sample size	Study duration	Social messaging apps	OH promotion methods	Findings
Al-ak'hali <i>et al.</i> , 2020 (Saudi Arabia) ⁽¹⁵⁾	RCT	43 male dental patients with gingivitis	3 months	Intervention: WhatsApp Comparison: Conventional oral health education	Weekly Dental care WhatsApp messages Comprehensive OHE given at baseline	Statistically significant improvement in oral health status (PI and GI score) in both groups. The averages of PI and GI were not significantly different between both groups at any time point of measurement (baseline, after one, and three months; $p>0.05$). Indicative no additional effects for using WhatsApp messages for study purposes.
Borujeni <i>et al.</i> , 2021 ⁽¹⁷⁾ (Iran)	Single-blinded RCT	60 fixed orthodontic patients	16 weeks	Intervention: Telegram Comparison: Conventional OHE	OHE videos of 5-7 minutes via Telegram Conventional comprehensive OHE after the 1st session	There was a statistically significant difference in PI and BOP between the two groups at the 3rd and 4th appointments ($p\leq0.01$). Significant differences in gingiva consistency between the intervention and control groups at the 3rd and 4th appointments ($p\leq0.05$).
Malik <i>et al.</i> , 2019 ⁽¹¹⁾ (India)	RCT	34 orthodontic patients in active treatment with fixed appliances in both arches	5 weeks	Intervention group: WhatsApp Comparison: Practo Software (text messaging)	WhatsApp reminders on OHI with added graphics sent twice a week Text messages on OHI without added graphics sent twice a week	Significantly lower BI ($p<0.001$), MGI ($p<0.001$), and PI ($p<0.001$) scores were observed at follow up (after 8 weeks) and improved over time in the intervention group. WhatsApp messages with graphic content were more effective in reminding orthodontic patients of oral hygiene practices.
Saxena and Gunjal, 2022 ⁽²¹⁾ (Malaysia)	Double-blinded parallel-group RCT	54 orthodontic patients with fixed orthodontic mandibular and maxillary appliances	4 weeks	Intervention: WhatsApp	WhatsApp reminders (text and images) to maintain oral hygiene sent once a week	No statistically significant difference in the mean plaque scores inter-group regardless of time ($p=0.360$). At eight weeks, the WhatsApp group showed a greater reduction in the plaque score with a mean difference of 8.12, followed by the email group with a mean difference of 6.32 and the least reduction in the control group with a mean difference of 3.90.
Wu <i>et al.</i> , 2022 ⁽¹⁹⁾ (China)	Non-blinded RCT	44 fixed orthodontic patients	12 weeks	Intervention: WeChat Comparison: Conventional routine oral health education	WeChat mini program: - Notification for toothbrushing - Periodic use of a disclosing agent with photography - Toothbrushing, clocking with videos of toothbrushing Received care via conventional methods	Significant differences in dental plaque between the intervention and control at 6 weeks ($p<0.0001$) and 12 weeks ($p<0.005$). The intervention group recorded a gradual declining trend of gingival bleeding than the control group.
Zotti <i>et al.</i> , 2019 ⁽¹⁴⁾ (Italy)	RCT	60 patients undergoing post-orthodontic treatment	12 months	Intervention: WhatsApp for the "Relapse Game" Interaction with another member of the group using text and emoticons.	Intraoral selfies shared in the WhatsApp group to earn points for the "Relapse Game" Interaction with another member of the group using text and emoticons.	A significant difference in intercanine width between the groups was noted ($p\leq0.05$). Higher compliance with wearing post-orthodontic retainers among adolescent patients in social media activity with a lower relapse rate.

BI: bleeding index; BOP: bleeding on probing; GI: gingival index; MGI: modified gingival index; OH: oral health; OHE: oral health education; OHI: oral hygiene instruction; PI: plaque index; RCT: randomized controlled trial

Table 5: Social messaging applications, KAB, and oral health status.

Reference (Country)	Study design	Study population and sample size	Study duration	Social messaging apps	OH promotion methods	Findings
Deghatipour <i>et al.</i> , 2021 ⁽¹⁰⁾ (Iran)	RCT	439 pregnant women in the second/third trimester of pregnancy	Beginning of pregnancy until 18 months post-delivery	Intervention: Telegram Comparison: Comprehensive	Telegram messages on behavioral content (n=41) and nutritional content (n=43) every week Comprehensive intervention combining all methods Group discussions performed every three months	A higher number of caries-free children in the intervention group (78.8%) than in the control group (56%). All the four intervention groups except social networks resulted in more chance of being caries-free compared to the control group. Higher frequency of using finger tooth brushing (30%) at 24 months in the intervention groups compared to the control group, but the lowest difference was in the social network group. Higher no-sweet intake in the intervention group than in the control group, but the lowest difference was in the social network group. Intervention of social networks alone has not been effective in the study compared to other methods.
Li <i>et al.</i> , 2015 ⁽²⁰⁾ (China)	Non-blinded, two-arm randomized controlled trial	224 adolescent and adult orthodontic patients	33 months	Intervention: WeChat Comparison group: Conventional management	Reminder (brief text) and educational message (rich texts and pictures) sent via WeChat Not mentioned	Shorter duration of treatment in the intervention group than in the control group (range 66-93 weeks vs 75-103 weeks; $p=0.007$) A smaller percentage of patients with failed attendance in the intervention group than in the control group (RR = 0.42, 95% CI: 0.31- 0.57) There was no significant difference between the two groups in the OPI or MGI in either baseline or endpoint evaluation.
Lotto <i>et al.</i> , 2020 ⁽¹⁸⁾ (Brazil)	Single-blinded, 2-parallel arm, randomized controlled trial	104 parents and children aged 36-60 months	6 months	Intervention: WhatsApp Comparison: Not mentioned	Parents or caregivers received educational text messages and audio narration of ECC via WhatsApp messages every 2 weeks Did not receive any other educational material or information	Similar percentages of caries-free lesions were reported from both groups after 6 months. Participants with the increment of maximum ICDAS did not increase significantly in the intervention group (15.4-23.1%, $p=0.125$) as opposed to the control group (21.2-36.5%, $p=0.008$) between 3- and 6-month follow-ups. No significant difference in the parental eHealth literacy eHEALS score between groups at all periods. Parents of the intervention group reported significantly higher consumption of sugar-free sweets but lower intake of sugar-free foods by their children.
Pithomchayakul <i>et al.</i> , 2022 ⁽²⁴⁾ (Thailand)	Quasi-experimental design (pre-test and post-test)	71 pairs of caregivers and children aged 6 months to 36 months	Study I: 21-day FunDee Study II: 30 days FunDee	2 chatbots, 21-day FunDee (Study I) and 30-day FunDee (Study II), based on the protection motivation theory	The chatbots operating on Facebook Messenger were designed to engage and motivate the users through texts, videos, clips, or infographic exchanges from 3-5 minutes each.	Both chatbots recorded statistically significantly increased overall knowledge of children's toothbrushing information. Study I showed a significant difference in the improvement of frequency of daily toothbrushing ($p=0.02$), along with a significantly greater understanding of child oral healthcare and significant plaque reduction.
Subburaman <i>et al.</i> , 2021 ⁽¹³⁾ (India)	Randomized controlled trial	140 college students	3 months	Intervention: WhatsApp Comparison: None	Received oral health education through WhatsApp (pictures, videos, and text messages) Restrained from any form of oral health education after initial exposure at baseline	Higher mean difference in KAB scores in the intervention group (170.73%, 73.38%, 60.19%) than in the control group (46.19%, 36.45%, 35.67%). Gradual reduction of mean OHI-S and MGI scores recorded in the intervention group. In the control group, the OHI-S score was reduced in the first month but increased during the third and sixth months.

CI: confidence interval; ECC: early childhood caries; eHEALS: health literacy scales; ICDAS: international caries detection and assessment system; KAB: knowledge, attitude, behavior; MGI: modified gingival index; OH: oral health; OHI-S: simplified oral health index; OPI: ortho-plaque index; PHCP: primary health care providers; RCT: randomized controlled trial; RR: relative risk.

voice notes, and short video clips. Several studies have demonstrated that supplementing text messages with multimedia components, such as images and audio narration can improve comprehension of OH messages.^(11,17,20) For instance, one study enhanced OH information for young parents and caregivers by incorporating voice-read passages within mobile messages, which increased accessibility and supported better understanding.⁽¹⁸⁾ This aligns with U.S. findings showing that multimedia-rich messages are more engaging, reduce language barriers, and provide clearer modelling of preventive behaviors.⁽²⁹⁾

In terms of improving OH knowledge among young adults, messaging platforms have been shown to facilitate stronger engagement and retention of key information when motivational and educational content is delivered directly to users' mobile devices.^(18,22,23) Additionally, several studies have reported positive changes in oral hygiene behaviors, such as increased tooth brushing frequency, healthier dietary choices, and improved compliance with orthodontic retainer use, following interventions delivered through social messaging apps.^(14,24)

A study by Li *et al.*,⁽²⁰⁾ reported that orthodontic patients showed better attendance and shorter treatment duration. However, the use of messaging app teaching and reminders did not lead to improvements in oral hygiene. In contrast, Wu *et al.*,⁽¹⁹⁾ demonstrated significant oral hygiene improvements among young adults with fixed orthodontic appliances using a WeChat intervention. The main distinction is that the Wu and colleagues study incorporated additional behavior change strategies into the social messaging app, including goal setting, self-monitoring, discussions on coping strategies, and motivational messaging during the volitional phase. These examples suggest that active social communication and accountability via messaging platforms are more effective than simple reminders or information alone.

Studies have shown that physicians and health professionals were the first sources of health information among participants.^(30,31) However, clinical consultations between patients and providers are typically brief due to time constraints, limiting tailored interventions and ongoing support. Social messaging enables ongoing convenient OH education and knowledge transfer beyond dental clinic visits. It allows for an ongoing, tailored key OH education exchange between dental appointments.^(13,22) Social messaging apps also create opportuni-

ties for dialogues for patients to ask questions and clarify misunderstandings and doubts about their condition⁽¹²⁾, enabling healthcare providers to give real-time feedback on techniques like brushing beyond clinical settings and correcting of improper methods to reduce disease risk.⁽¹⁹⁾ Similarly, an alcohol reduction study among students stresses the importance of having timely psychosocial support from healthcare providers. Collaboration by setting appropriate goals with students through messaging apps can improve the outcomes of drinking habits.⁽³²⁾

Despite evidence of improved KAB and OH status, several studies did not show significant differences in either KAB or OH status.^(15,16,21) A study from Al-ak'hali *et al.*,⁽¹⁵⁾ reported that WhatsApp usage in health education delivery did not yield any added benefit to the conventional method of oral hygiene delivery, which is likely due to the intensive baseline instructions provided by an OH professional to both groups on proper brushing techniques, flossing, and oral hygiene aids. Such intensive initial education may have minimized any additional benefits of WhatsApp messaging.⁽¹⁵⁾ Moreover, interventions that combine social messaging app components with other modalities, such as in-person instruction and dental visits, seem to achieve better outcomes than social messaging apps alone.⁽¹⁰⁾ Thus, it is arguable that comprehensive in-person intervention has probably managed to provide better skill demonstrations and support that may be limited to digital-only interventions. Similarly, according to a systematic review, digital interventions such as using smartphone apps provide mixed evidence of effectiveness against non-digital interventions on health behaviors among adults.⁽³³⁾ Therefore, in light of evidence that has been explored in the literature, a blended model that integrates social messaging apps as a complement to non-digital delivery methods such as in-person interventions and peer support should be considered to provide optimal OH promotion efforts.

This review is subject to several limitations. Firstly, it restricts inclusion to English publications, excluding non-English publications and grey literature. The scope is confined to studies employing intervention and control or pre-post analysis, with a specific focus on the impact of OH knowledge, attitude, behavior and selected OH status using clinical indicators. The review also does not account for potential influences arising from varying follow-up periods or differences in patient participation. Thus, care-

ful interpretation of the review's findings is warranted.

Conclusions

It can be concluded that social messaging apps demonstrate potential to promote positive OH knowledge, attitudes, and behaviors, and to some extent improve OH status (i.e., gingival status, dental plaque, caries free). Given the platform's contemporary form and continuous evolution, more in-depth research into optimal use for OH promotion is required. Investigating user preferences, engagement tactics, and the most beneficial social messaging approach can inform patient-centric solutions that enhance OH status. Furthermore, examining consumer privacy and functionality needs will support the development of adaptive, ethical interventions that enhance patient health alongside technological adoption.

Conflict of Interest

The authors declare no conflict of interest.

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