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REVIEW ARTICLE

The effect of mass media campaigns on oral health knowledge: A systematic review and meta-analysis

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Abstract

Objectives: Knowledge and awareness gained from mass media can prepare people for lifestyle changes and impact their health and well-being. Considering the differences in the results of primary studies, we decided to conduct this study to evaluate the effect of mass media campaigns on oral health knowledge as a systematic meta-analysis and review.

Method: The databases such as the Web of Sciences (ISI), Scopus, PubMed/Medline, and the Cochrane Library were searched systematically until February 2022. Data pooling was performed using a random effects model. The effect sizes were estimated as odds ratios (ORs) with their 95% confidence intervals (CIs). Additional analyses, including sensitivity, subgroup, and publication bias analyses, were also conducted.

Results: Our meta-analysis comprised a total number of seven articles. The pooled results indicated significant increases in oral health knowledge among included studies (OR = 1.64, 95% CI: 1.20–2.24, $p < 0.001$). In subgroup analyses, the effects of mass media campaigns on oral health knowledge remained significant for the studies with follow-up of less than 150 weeks (OR = 1.69, 95% CI: 1.49–1.91) and working-age populations (OR = 1.80, 95% CI: 1.40–2.32) compared to other categories.

Conclusion: In general, this study showed that mass media campaigns may have positive effects on oral health knowledge, especially in the working-age population; it seems that for improving health knowledge among children, more initiatives are needed. Besides, the effects of these campaigns seem to be time-dependent and higher in shorter follow-up periods.

KEYWORDS
health promotion, knowledge, mass media, meta-analysis, oral health, systematic review

1 | INTRODUCTION

Oral health is an important aspect of public health and could affect an individual's quality of life and well-being.[1–3] Major advances have been made in oral health to reduce the burden of this health issue.[4] These advances prevented, diagnosed, and treated oral diseases, from promoting screening visits to applying products such as fluoride toothpaste and new techniques such as advanced dental materials and implants.[5–7] It has, however, been reported that oral diseases are neglected epidemics, with 3.5 billion individuals worldwide having different types of oral disease.[8,9] It has been reported that there are still inequities in having access to oral health worldwide.[10,11]

There are well-established systems in developed countries that monitor and manage issues related to oral health to prevent oral diseases.[12,13] However, an obvious lack of preventive measures exists in developing or less-developed regions, where the population is more involved with oral diseases. These preventive measures can significantly alleviate the burden of oral diseases on individuals and the healthcare system while remaining cost-efficient. Given their potential benefits, it is imperative to prioritize these measures and direct greater attention toward their implementation.[10] World Health Organization recommends a "common risk factor" approach, which focuses on identifying shared risk factors for major oral diseases such as periodontitis, especially those behavioural risk factors such as smoking.[14,15]

To modify these shared risk factors and behavioural change, there is a need to improve the population's knowledge and awareness about oral health.[16] This aim could be achieved through several means.[17–21] Taking benefits from mass media is one of these effective means. Risk factors for health and preventive measures could be taught using this media.[22,23] The effect of the mass media on prevention and health promotion is mainly exerted by repeating concepts for desired health-seeking behaviour through different symbols and themes.[24] In developing and less-developed countries, mass media services such as television and radio are widely used, and they could play an important role in conveying information regarding health, including oral health.[25–27] The effect of the media has been reported in different studies; these studies have demonstrated that the effect is more in the population in less-developed regions, and mass media campaigns are more effective in these countries.[28–32] Therefore, we decided to conduct this study to assess the effect of campaigns using the mass media on oral health knowledge as a systematic review and meta-analysis.

2 | METHODS

Electronic databases were systematically searched, including the Web of Sciences (ISI), Scopus, PubMed/Medline, and the Cochrane Library up to February 2022. The searches were performed to retrieve all studies with pre-to-post designs that investigated the effect of mass media campaigns on improving oral health knowledge. We used the following keywords for the search strategy process: ("Mass Media" OR "Campaign" OR "Social Network" OR "Social Media" OR "Publicity Campaign" OR "Market" OR "TV" OR "Television" OR "Film" OR "Cinema" OR "Radio" OR "Movie" OR "Broadcasting" OR "Magazines" OR "Leaflets/Booklets" OR "Email" OR "Newspapers") AND ("Oral Health Knowledge" OR "Dental Health Knowledge" OR "Dental Knowledge" OR "Oral Knowledge OR 'Periodontal Knowledge' OR Oral Care Knowledge" OR "Oral Hygiene Information" OR "Dental Information"). Besides, references of the secondary studies and those included in this systematic review were manually checked to pursue further studies. The reporting of the current study was according to the standards of the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) guidelines.[33]

2.1 | Study selection and inclusion criteria

Studies were included if they met the following inclusion criteria: being a before–after study with or without control groups, assessing the effect of mass media campaigns on oral health knowledge among people of all ages, reporting sufficient information requirements for estimating the knowledge among participants before and after mass media campaigns and being published in the English language. We considered mass media oral campaigns "the purposeful use of mass media channels to influence health behaviors and the individual level determinants of health behaviors".

Two authors (M.B. and M.A.) independently assessed the initial search records according to inclusion criteria. If there was a disagreement between the two authors, it was resolved by discussion; if no agreement could be reached, they discussed it with a third author (RT).

2.2 | Data extraction

The following data were extracted using a standard Excel form: first author's name, publication year, country, characteristics of participants, sample size (the before–after study), type of study, follow-up period, mass media which was used for oral campaigns, and the level of oral knowledge before and after campaigns.

Studies with more than one oral health knowledge proportion related to different populations were considered separate studies in the current study. Graphical data were converted by using the plot-digitizer software.[34]

MA rechecked the data as a third author after two authors (M.B. and M.V.) extracted all of the pertinent data from included studies.

2.3 | Quality assessment

The National Institute of Health's (NIH) tool was used to evaluate the quality of included records with a before–after design. The NIH tool covers aspects such as: "selection bias, information bias, measurement bias, and confounding risk," of which there are 12 questions in this tool. Finally, studies were categorized into three groups, including poor, fair, and good, with scores of ≤3, 4–7, and ≥8, respectively.

2.4 | Statistical analysis

Comprehensive Meta-analysis (CMA) Version 2.0 and STATA version 11.0 (Stata Corp., College Station, TX) were used to analyse the extracted data statistically. The effect of the mass media campaign

was measured by using odds ratios (ORs) and their corresponding 95% confidence intervals (CIs). These effect sizes were pooled using random effects model. The association between mass media campaigns and oral knowledge in the study conducted by Gholami et al.[35] was estimated using matched groups in CMA. Heterogeneity across included studies was evaluated using the Cochrane *Q* test and I^2 statistic. Besides, we conducted sensitivity analysis and subgroup analysis. Begg's and Egger's tests were used to estimate the evidence of potential publication bias between studies.

3 | RESULTS

3.1 | Main characteristics of included studies

Figure 1 shows the step-by-step study selection and identification process from initial search findings with the reason and number for excluding records. A total of 812 citations were identified in initial comprehensive searches, but 627 were removed as they were duplicates, irrelevant, or previous review studies. A total of 185 records

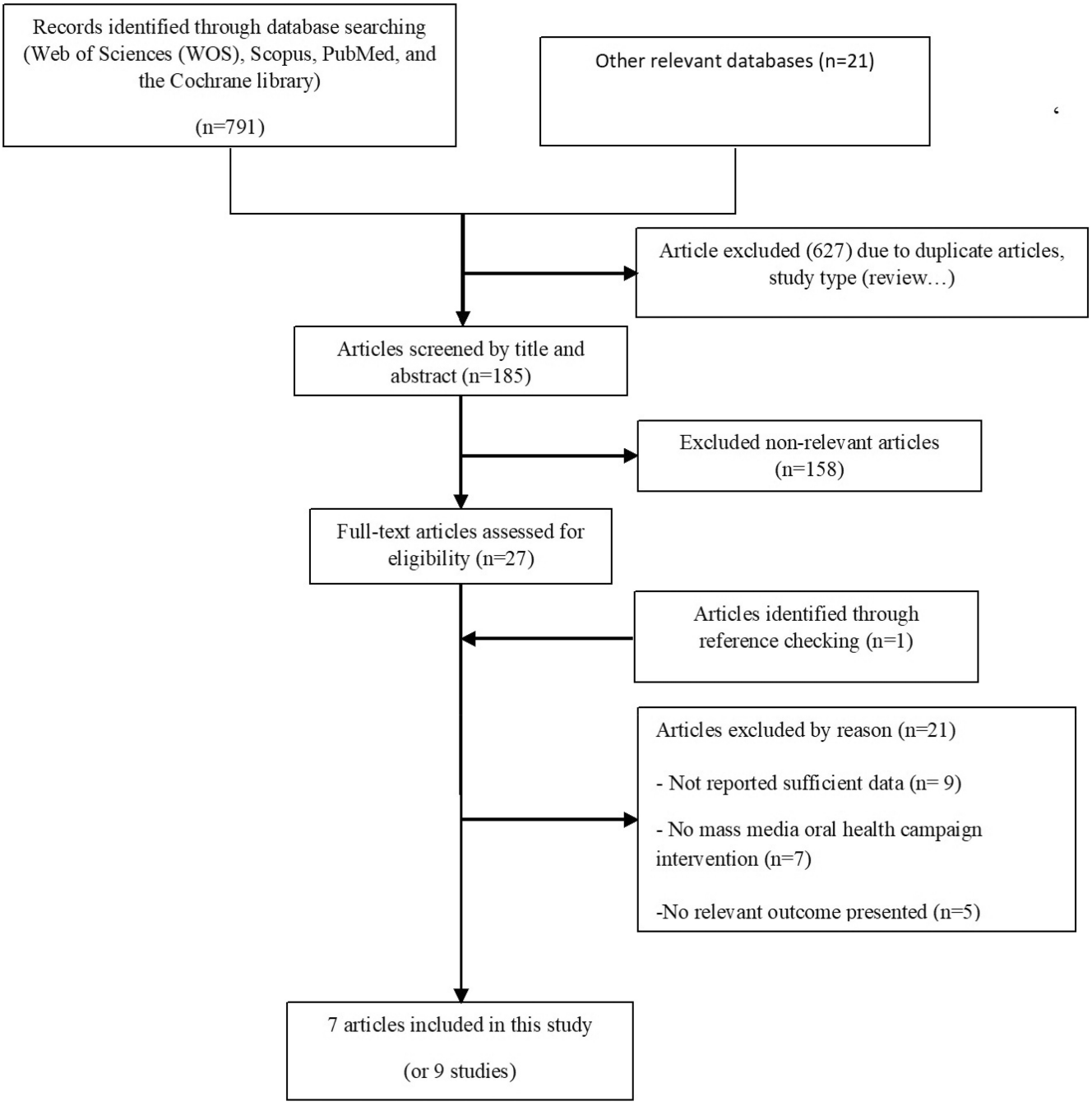

FIGURE 1 PRISMA flowchart of study identification and selection process.

were removed after checking the titles and abstracts. Then, 27 records remained for the second screening, whether they met the inclusion criteria after retrieving their full texts. Of these, 21 articles were removed as they did not report sufficient data ($n=9$), did not consider a mass media on oral or dental campaigns ($n=7$), and did not indicate the relevant outcomes ($n=5$). Finally, seven articles (or nine studies) were included for the final quantitative analysis in this meta-analysis.

The included studies were conducted between 1984 and 2019. All these articles were conducted with a before–after design.[35–40] The total number of participants before the intervention was 5960, and after the intervention was 17,764. The follow-up duration between the pre and post-period varied from 6 weeks[38] to 288 weeks[37] among the included studies. Besides, in four articles, change in oral health knowledge among only the working-age population was assessed; in two articles, the change in only children and in one article, change in both age groups were aimed to be evaluated. The main characteristics of the included studies are provided in Table 1.

3.2 | Meta-analysis findings

Figure 2 shows the effects of mass media campaigns on oral health knowledge. The pooled random effects model results indicated significant increases in oral health knowledge among studied-population (OR = 1.64, 95% CI: 1.20–2.24, $p<0.001$). We observed a significant inter-study heterogeneity (I^2: 93.18%, $p<0.001$). As shown in Figure 3, the pooled ORs remained consistent following the sensitivity analyses after excluding the one-by-one study.

Subgroup analyses were also conducted according to potential moderator variables, including follow-up duration (<150 weeks vs. ≥150 weeks), type of populations (children or young adolescents vs. working-age population), and the quality of included articles (good vs. fair).

The effect of mass media campaigns on oral health knowledge remained significant for the studies with follow-up <150 weeks (No studies: 5, OR = 1.69, 95% CI: 1.49–1.91, $I^2=0.0\%$) compared to ≥150 weeks (No studies: 4, OR = 1.55, 95% CI: 0.85–2.82, $I^2=96.51\%$), and among working-age populations (No studies: five, OR = 1.80, 95% CI: 1.40–2.32, $I^2=76.47\%$) versus studies with children or young adolescents (No studies: four, OR = 1.36, 95% CI: 0.75–2.47, $I^2=95.84\%$). In addition, the effect of mass media campaigns on oral health knowledge was changed in studies with good quality (No studies: two, OR = 1.11, 95% CI: 0.39–3.14, $I^2=95.98\%$) compared to studies with fair quality (No studies: seven, OR = 1.75, 95% CI: 1.46–2.09, $I^2=69.43\%$).

3.3 | Publication bias and quality assessment

The Begg's rank correlation test and regression-based Egger test for small-study effects indicated significant potential publication bias between studies (P Egger's test = 0.01, P Begg's test = 0.02). So, the non-parametric method (Duval and Tweedie) was used to estimate the findings of missing studies. The test indicated that the pooled effect size for the association between mass media campaigns and oral health knowledge did not significantly change before and after the inclusion of missing studies. Among these included articles, two articles[35,40] were of good quality, and the remaining five articles[36–39,41] were considered fair quality based on the NIH tool (Table 2).

4 | DISCUSSION

Social marketing could be used effectively to promote health behaviours, for example, by using mass media-based health communication strategies to achieve predetermined goals.[42] This meta-analysis and systematic review examined the effect of mass media campaigns on improving oral health knowledge. In general, these mass media campaigns could significantly impact oral health knowledge. Mass media campaigns are mainly applied to deliver messages to large audiences. As exposure to these mass media programmes is mainly not in an active context, such programmes often compete with other existing determinants such as marketing, common social rules and regulations, and behaviours that result from addiction or habit.[43]

Similar findings have been reported in other studies. In another study conducted in Norway, a programme on periodontal health in the mass media was consistently designed. This programme gave information regarding the prevention and control of periodontal disease. Another study showed that this campaign increased the population's knowledge for about 3 years afterwards.[44] Improving public awareness about periodontal and oral health has been observed after a campaign on periodontal health and diseases was held in New Zealand.[45] However, in a systematic review of 46 studies, mass media programmes were reported not to be effective, and they stated in their study that the quality of oral health promotion evaluation research should be improved. Perhaps one of the reasons for the difference in the observations on the effectiveness of mass media programmes is the complex nature of mass media programmes themselves. For example, the impact of mass media programmes alone is not much visible, but when it is combined with laws and education, especially at a young age, its impact will be more visible; Also, the duration of mass media programmes as well as oral and dental disease monitoring systems in different countries can be effective in influencing this type of intervention.

Using mass media has a long history of delivering health messages. Literature has demonstrated that using these campaigns could benefit individuals' points of view, health-seeking behaviours, and ability to take control of their health.[46,47] These beneficial effects include smoking cessation and nonsmoking tobacco products, testing for human immunodeficiency virus (HIV), and in-time referring to physicians.[48–50] In addition, evidence from previous reports showed that campaigns for oral health promotion conducted through the mass media could attract the audiences' attention, shape their points of view, motivate their concerns, and encourage them to change behaviours.[28,32,39,51] The effect of mass media campaigns is more prominent in developing

TABLE 1 Main characteristics of the included studies.

Authors (ref)	Publication Year	Country	Study design	Mean age (years)	Monitoring period	Type intervention	Quality status
Peng et al. (Peng et al. 1997a)	1997	Japan	Survey (before–after)	10–19	6 years	First of all radio, television and newspapers. Health education materials were produced (for example, pamphlets, posters, materials for lectures, macro-models)	Fair
Peng et al. (Peng et al. 1997b)	1997	Japan	Survey (before–after)	40 or more	6 years	First of all radio, television and newspapers. Health education materials were produced (for example, pamphlets, posters, materials for lectures, macro-models)	Fair
Martensson et al. (Mårtensson et al. 2004)	2004	Sweden	Before–after with a cohort design	50–75	6 months	Campaign through brochures, newspapers, radio and TV	Fair
Gholami et al. (Gholami et al. 2017)	2017	Iran	Observational survey study(matched before–after)	18–50	3 months	National TV campaign	Good
Sogaard et al. (Søgaard 1988)	1988	Norway	Survey (before–after)	15 or more	4 years	Television and radio programmes, articles in newspapers and weekly magazines, and a pamphlet presenting	Fair
Murtomaa et al. (Murtomaa and Masalin 1984a)	1984	Finland	Survey (before– after)	15–50	3 years	Mass media communication	Fair
V-Montenegro et al. (Villavicencio-Montenegro and León-Manco 2019)	2019	Peru	Longitudinal retrospective study-survey (before–after)	Under 12	4 years	Mass media like television and radio	Good
Friel et al. (Friel et al. 2002a)	2002	Ireland	Experimental before–after study	7–8	6 weeks	Dn TV campaign	Fair
Friel et al. (Friel et al. 2002b)	2002	Ireland	Experimental before–after study	11–12	6 weeks	Dn TV campaign	Fair

countries.[30] A systematic review showed the beneficial effect of using mass media on participants' knowledge about the routes of transmission of HIV, personal and environmental risk factors associated with the increased transmission, and how to reduce these behaviours in developing countries.[52] However, in more developed regions, the effects of mass media may not be this prominent.[41] Also, the findings of the scoping review show the promise of mass media campaigns to promote oral health by achieving campaign recall and short-term improvement in oral health knowledge and behaviours.[23] However, using mass media for such campaigns is quite costly, and if they want to become commonplace, they need a reliable funding source. There is a doubt whether these techniques may be effective in less-developed regions,[30] especially when they are consistent with the policies determined by the government. Also, numerous factors, including the viewers' perception of the campaigns, their duration, and the frequency of exposure to the programme, may be important in the extent of influence that mass media campaigns could exert.[45]

According to subgroup analysis, based on the duration of the follow-up of the campaigns, less than 150 weeks of follow-ups showed a higher rate of improvement in oral health knowledge. However, there was no significant difference in campaigns with follow-up durations longer than 150 weeks. In some studies, it is stated that the media campaign's impact diminished over time. As Kay and Locker showed in their study, the impact of health education is not

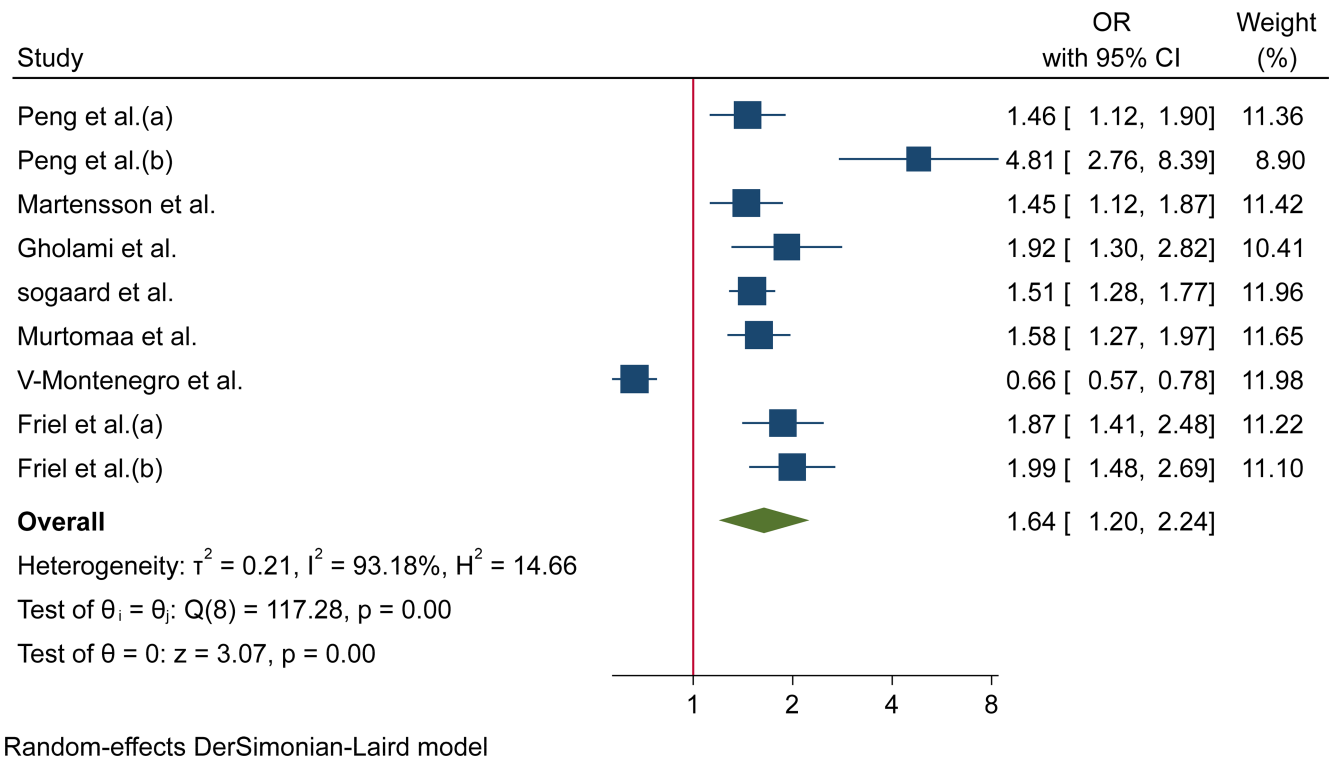

FIGURE 2 The forest plot of each included study and the pooled result on the association of mass media campaigns and oral health knowledge.

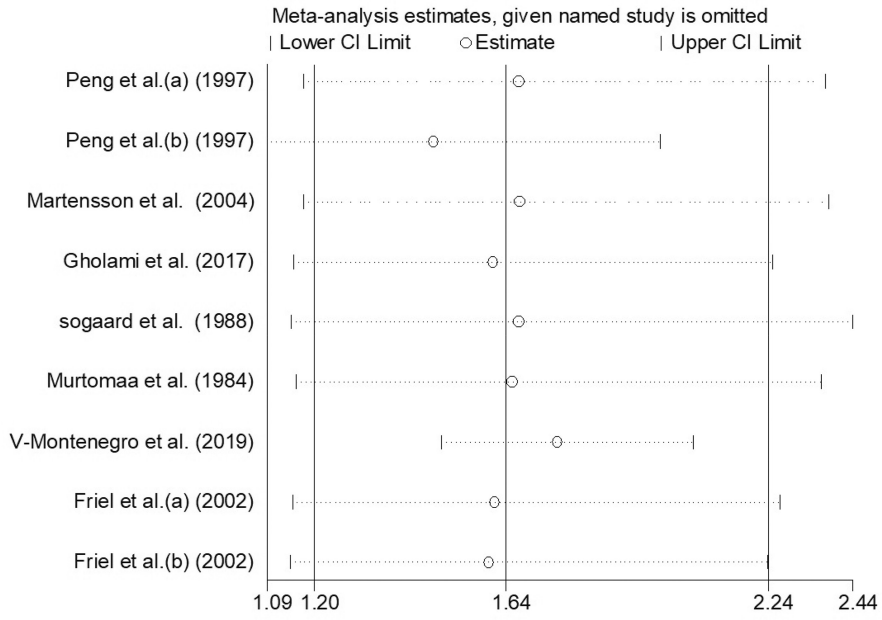

FIGURE 3 Results of the sensitivity analyses after removing each study.

permanent.[53] Previous campaigns on oral health that have spread over for more prolonged durations have also shown a more sustainable improvement in knowledge.[45]

Regarding the target population, our study demonstrated that the working-age population was more affected by mass media campaigns than the population of young children or adolescents. Another study found that campaigns had little, if not any, effect on the oral health of children.[38] The study also addressed the interaction between intervention through mass media campaigns and school interventions for children. This study valued the combination of these two interventions and the synergistic effect that they could have in behaviour change theory.[38,54,55]

Our study had several limitations. First, there was substantial heterogeneity between the included studies; we tried to find the source of heterogeneity by performing subgroup analyses. Second, a significant potential publication bias was observed using Begg's rank correlation and regression-based Egger tests. Trim and fill analysis showed that this publication bias did not influence the analysis results.

TABLE 2 Quality assessment of included articles with NIH quality assessment tool.

Criteria	Peng et al.[26]	Martensson et al.[27]	Gholami et al.[25]	Sogaard et al.[28]	Murtomaa et al.[29]	V-Montenegro et al.[30]	Friel et al.[31]
1. Was the study question or objective clearly stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Were eligibility/selection criteria for the study population prespecified and clearly described?	No	No	Yes	No	Yes	Yes	No
3. Were the participants in the study representative of those who would be eligible for the test/service/intervention in the general or clinical population of interest?	Yes	Yes	Yes	No	N/A	N/A	Yes
4. Were all eligible participants that met the prespecified entry criteria enrolled?	N/A	N/A	N/A	Yes	N/A	Yes	N/A
5. Was the sample size sufficiently large to provide confidence in the findings?	Yes	Yes	Yes	N/A	No	Yes	Yes
6. Was the test/service/intervention clearly described and delivered consistently across the study population?	No	No	Yes	Yes	Yes	Yes	No
7. Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8. Were the people assessing the outcomes blinded to the participants' exposures/interventions?	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9. Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?	Yes	Yes	Yes	N/A	Yes	Yes	Yes
10. Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided p values for the pre-to-post changes?	Yes	Yes	Yes	N/A	Yes	Yes	Yes
11. Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?	Yes	Yes	Yes	N/A	N/A	Yes	Yes
12. If the intervention was conducted at a group level (e.g., a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?	N/A	N/A	N/A	N/A	Yes	N/A	N/A
Quality findings	Fair	Fair	Good	Fair	Fair	Good	Fair

Abbreviations: N/A, not applicable; NIH, National Institutes of Health.

Third, another limitation was the type of studies included in this review. Due to limited literature, before and after studies were included and entered the quantitative analyses. This type of study will have an internal limitation because it does not have a control group. Therefore, it is recommended that researchers also consider the issue and design studies the control group has for comparison in future works. Another issue to consider is the inherent limitation of these campaigns as the use of campaigns alone cannot be examined, and some factors may confound the relationship between campaigns and oral health knowledge, such as other educational and information resources.

5 | CONCLUSION

Our study demonstrated that mass campaigns may affect oral health knowledge, especially in the working-age population.

Besides, as our study showed a non-significant change in oral health knowledge in children and adolescents, it seems that there is a need to combine mass media campaigns with other methods of conveying health messages, such as education at schools, to have a favourable influence on their oral knowledge in this age group. Also, our study showed that campaigns with shorter follow-up durations have a greater impact on oral health knowledge. Perhaps one of the reasons for observing this finding is the possibility of the presence of recall bias in the study participants, which may indicate that repetitive campaigns instead of a single campaign are needed to improve health knowledge. However, in future studies, it is necessary to investigate and compare the impact of campaigns with other educative strategies and the interaction between them.

6 | CLINICAL RELEVANCE

Modifying risk factors for oral diseases and behavioural changes require meticulously planned strategies to improve health knowledge. One way to achieve this is to use mass media. Our results showed that these mass media campaigns may effectively improve public health knowledge.

AUTHOR CONTRIBUTIONS

Morteza Banakar: contributed to the conception and design, interpretation, drafted the manuscript, and critically revised the manuscript. KB Lankarani: contributed to the conception, interpretation, drafted the manuscript, and critically revised the manuscript. Mohebat Vali: contributed to the conception, interpretation, and drafting of the manuscript and critically revised manuscript. Reza Tabrizi: contributed to conception and design, contributed to analysis and interpretation, drafted the manuscript, and critically revised the manuscript. Erfan Taherifard: contributed to the conception, contributed to interpretation, drafted the manuscript, and critically revised the manuscript. Maryam Akbari: contributed to conception and design, contributed to analysis and interpretation, drafted the manuscript, and critically revised the manuscript. All authors gave their final approval and agreed to be accountable for all aspects of the work.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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