Motivational Interview (MI) Intervention with a Combination Method Face-To-Face with During on the OHI-S Status of Adolescents in Gorontalo

Deliyana Imelda Katili *, Ayub Irmadani Anwar, Ichlas Nanang Afandi, Irfan Sugianto, Arsunan Arsin, Indra Fajarwati Ibnu, Nurlindah Hamrun, Irwan

Posted Date: 31 March 2026

doi: 10.20944/preprints202603.2484.v1

Keywords: motivational interviewing; application; dental health; adolescents; digital health

 doi:10.20944/preprints202603.2484.v1

Article

Motivational Interview (MI) Intervention with A Combination Method Face-To-Face with During on the OHI-S Status of Adolescents in Gorontalo

Deliyana Imelda Katili [1,*], Ayub Irmadani Anwar [2,*], Ichlas Nanang Afandi [3], Irfan Sugianto [4], Arsunan Arsin [5], Indra Fajarwati Ibnu [6], Nurlindah Hamrun [7] and Irwan [8]

[1] Faculty of Dentistry, Hasanuddin University, Makassar 90245, Indonesia
[2] Department of Dental Public Health, Faculty of Dentistry, Hasanuddin University, Makassar 90245, Indonesia
[3] Department of Psychology, Faculty of Medicine, Hasanuddin University, Makassar 90245, Indonesia
[4] Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Hasanuddin University, Makassar 90245, Indonesia
[5] Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Makassar 90245, Indonesia
[6] Department of Health Promotion and Science Behaviour, Faculty of Public Health, Hasanuddin University, Makassar 90245, Indonesia
[7] Department of Oral Biology, Faculty of Dentistry, Hasanuddin University, Makassar 90245, Indonesia
[8] Department of Public Health, Faculty of Sport and Health, Gorontalo State University, Gorontalo, Indonesia
* Correspondence: delykatili72@gmail@.com; Tel.: +62-811-434-104

Abstract

Background/Objectives: The dental and oral health status of adolescents in Indonesia, especially in Gorontalo City, remains concerning with a high caries prevalence. Conventional education efforts are less effective in forming sustainable healthy behaviors. This study aims to evaluate the relationship between the implementation of application-based MI on oral health status (OHIS) in adolescents aged 15-18 years in Gorontalo City. **Methods**: This study used a quasi-experimental design with a non-randomized control and repeated measurements on 100 respondents aged 15–18 years. Respondents consisted of a combined MI group (face-to-face + mobile application) and a comparison group (face-to-face MI). The variables measured included knowledge, toothbrushing behavior, and the OHI-S at baseline and three follow-ups. Measurements were conducted at each stage. Analysis used non-parametric tests because the data were not normally distributed (Shapiro–Wilk, $p < 0.05$). The Wilcoxon test was used for within-group analysis, the Mann–Whitney test for between-groups, and the Friedman test for repeated data. The effect size (r) was calculated from the Z value, with $p < 0.05$ as the significance limit. **Results**: There was a statistically significant increase over time ($p < 0.05$) in both groups, with the combined MI group showing greater improvement in knowledge, toothbrushing behavior, and OHI-S scores compared to the non-combined MI group. **Conclusions**: The combined MI approach was associated with increased knowledge, TBP, and OHIS status in adolescents compared with face-to-face MI alone. However, due to its non-randomized design, these changes may be due to other variables not examined.

Keywords: motivational interviewing; application; dental health; adolescents; digital health

1. Introduction

Oral health is a crucial aspect of general health that significantly impacts an individual's quality of life. A healthy mouth not only means being free from diseases such as oropharyngeal cancer, infections, and gum disease, but also supports vital functions such as chewing, speaking, and expressing emotions [1–4]. Research shows a close relationship between oral health and various

 doi:10.20944/preprints202603.2484.v1

systemic diseases, such as diabetes, digestive disorders, stroke, and cardiovascular disease [5,6]. In Indonesia, according to the 2018 Basic Health Research (Riskesdas), oral health problems remain very high, with a prevalence of dental caries reaching 80% and an average DMF-T index of 4.6, far above the WHO standard [7]. This condition is exacerbated by low knowledge, limited access to dental health services, and poor dental care practices, especially among adolescents [8–11]. Dental caries and periodontal disease, which are common in adolescents, are generally caused by poor oral hygiene, allowing the accumulation of plaque containing pathogenic bacteria such as Streptococcus mutans and Lactobacillus, which can lead to pain, infection, and even tooth loss [12–14].

Dental health education efforts, such as Dental Health Education (DHE), are often not optimal in fostering sustainable behavior change [15–19]. One approach currently considered effective is Motivational Interviewing (MI), a client-centered counseling technique aimed at increasing intrinsic motivation to change health behaviors [20,21]. However, the implementation of conventional MI in schools and healthcare facilities still faces challenges, ranging from limited time and resources to minimal participant involvement. Furthermore, in Gorontalo Province, dental and oral health problems among adolescents are recorded as higher than the national average. Conventional counseling, which is one-way and passive, is less effective in fostering sustainable healthy behaviors in digital youth who are closely connected to technology [22–27].

The development of information technology, particularly mobile-based applications, opens up new opportunities for more interactive, personalized, and sustainable dental health promotion. The integration of app-based MI is considered to strengthen motivation, increase engagement, and shape more consistent healthy behaviors in adolescents [28–31]. Based on the problem description, it is clear that the high rate of dental caries in adolescents is difficult to overcome without effective oral health promotion and ongoing counseling education utilizing information technology. Therefore, this study was designed to answer the problem formulation: "Can the implementation of app-based Motivational Interviewing counseling improve the dental and oral hygiene status of adolescents?" Specifically, this study aims to analyze the effect of the implementation of app-based Motivational Interviewing by health cadres in improving the dental and oral health of adolescents in Gorontalo City. It is hoped that the results of this study can contribute to the development of innovative, effective, and evidence-based dental health promotion strategies in the digital era.

2. Materials and Methods

2.1. Study Design

This study applied a quasi-experimental non randomized with repeated measurements to evaluate the effectiveness of the combined MI intervention. The intervention was associated with improvements that were observed across the three-month follow-up period. Outcomes, including knowledge, tooth brushing behavior, and OHIS status, were assessed at baseline and at three post-test intervals corresponding to the end of the first, second, and third months. The comparison group received only face-to-face and served as a comparison for natural changes in oral health behavior.

2.2. Study Setting and Participants

This study was conducted in Gorontalo City, Indonesia, over a period of three months and involved 30 counselor cadres (dentists and dental nurses) and 100 adolescents aged 15–18 years. Participants were allocated into groups based on school clusters, with schools categorized into Group A (combined MI intervention) and Group B (face-to-face MI only). This approach was adopted to minimize contamination between participants within the same school environment. Due to this clustering strategy, randomization was not performed. Consequently, the possibility of selection bias cannot be excluded, and baseline equivalence between groups may not be fully ensured. However, both groups were drawn from comparable school settings within the same geographic area to reduce major contextual differences. The sample size was determined using the formula for comparing two independent means, with a significance level of 0.05 and a statistical power of 80%. Based on previous

 doi:10.20944/preprints202603.2484.v1

studies reporting a mean difference in OHI-S of 0.8–1.0 and a standard deviation of 1.2–1.4, the minimum required sample size was 45 participants per group. After accounting for a potential 10% dropout rate, the sample size was increased to 50 participants per group (total n = 100). This calculation was further verified using G*Power version 3.1, which indicated a minimum requirement of 90 participants; therefore, the total sample size was rounded up to 100 to enhance the statistical power of the study.

2.3. Intervention Description

The intervention consisted of motivational interviewing (MI) delivered in two formats: face-to-face MI and a combination of face-to-face MI with an application-based component. The face-to-face MI sessions were conducted by a licensed dentist and delivered directly in the school setting. These sessions focused on improving oral hygiene knowledge and tooth-brushing behavior through personalized counseling, goal setting, and behavioral reinforcement. Each session lasted approximately 30–45 minutes and was conducted weekly during the intervention period. In the combined MI group, participants additionally received an application-based intervention that could be accessed at any time. The application incorporated MI-based guidance, allowing participants to continuously engage with motivational content beyond face-to-face sessions. It also included reminders to promote oral hygiene practices, particularly regular tooth brushing. The application was supported by an AI-based system designed to assist participants throughout the MI process. Participants were guided to complete questionnaires within the application at each stage of the intervention, facilitating continuous engagement and self-monitoring. Participants were encouraged to use the application daily throughout the study period. Follow-up assessments were conducted at baseline, month 1, month 2, and month 3 to evaluate changes in knowledge, tooth-brushing behavior, and oral hygiene status.

2.4. Data Collection Instruments

Data were collected using structured instruments to assess knowledge, tooth-brushing behavior, and oral hygiene status. Knowledge was measured using a questionnaire consisting of 15 items covering key aspects of oral health, including dental hygiene practices, causes of dental caries, and preventive measures. Tooth-brushing behavior was assessed using a 24-item questionnaire evaluating the frequency, timing, and technique of tooth brushing. For both knowledge and tooth-brushing behavior, responses were scored using a dichotomous system, with “1” assigned for correct answers and “0” for incorrect answers. Total scores were calculated by summing item responses, with higher scores indicating better knowledge and behavior. The instruments were reviewed by experts in dental public health to ensure content validity and were pilot-tested prior to data collection to ensure clarity and consistency of the items. Oral hygiene status was assessed using the Oral Hygiene Index-Simplified (OHI-S) through clinical examination conducted by trained personnel following standardized procedures. OHI-S scores were categorized as good (0.0–1.2), fair (1.3–3.0), and poor (3.1–6.0).

2.5. Data Analysis

Data were analyzed using non-parametric statistical tests. The Wilcoxon signed-rank test was used to evaluate within-group differences between pre-test and post-test measurements. The Mann–Whitney U test was applied to assess differences between the intervention and comparison groups. The use of non-parametric tests was justified due to the non-normal distribution of the data and the ordinal nature of the measurement scales. Given the repeated-measures design, analyses were conducted using pairwise comparisons across time points. Effect sizes were calculated using the formula $r = Z/\sqrt{N}$.

2.6. Ethical Considerations

 doi:10.20944/preprints202603.2484.v1

This study received ethical approval from the Research Ethics Committee of the Faculty of Dentistry, Hasanuddin University, Indonesia (Approval No. 046/KEPK FKG-RSGMP UH/EE/XI/2024; 13 November 2024). This study was not registered as a clinical trial because it employed a quasi-experimental design and did not meet the criteria for mandatory clinical trial registration.

3. Results

Improvements in knowledge, tooth-brushing behavior, and OHI-S scores were observed across follow-up measurements. However, the analysis was conducted using pairwise comparisons, and no formal longitudinal analysis was performed to assess trends over time.

3.1. Baseline Characteristics of Adolescents

A total of 100 adolescents participated in this study, with 50 allocated to the combined MI group and 50 to the face-to-face MI group. Baseline comparability between groups was assessed using the Mann–Whitney U test. There were no statistically significant differences between groups in age, baseline knowledge score, tooth-brushing behavior, or OHI-S score ($p > 0.05$). However, slight differences in median values were observed between groups, suggesting that baseline equivalence cannot be fully assured. Therefore, the results should be interpreted with caution.

Table 1. Baseline Characteristics of Adolescents.

Variable	Combined MI (n=50) Median (IQR)	Face-to-Face MI (n=50) Median (IQR)	P-value*
Age (years)	16 (15-17)	16 (15-17)	0.842
Knowledge score	4 (3-5)	5 (4-6)	0.091
Tooth-brushing behavior	10 (8-12)	12 (10-13)	0.073
OHI-S score	3.2 (2.4 – 3.8)	2.8 (2.0-3.5)	0.112

Sources: Primary Data, 2025 *Mann-Whitney U test

3.2. Analysis of differences in Knowledge of MI interventions face to face with a combination (face to face with during)

Within-group analysis showed a statistically significant increase in knowledge scores in both groups following the intervention ($p < 0.05$), as presented in Table 1. However, the median post-test score in the combined MI group was higher than that in the face-to-face group, indicating that the addition of application-based Motivational Interviewing (MI) may have reinforced knowledge acquisition more effectively. Furthermore, the comparison between the two groups demonstrated that the integration of face-to-face methods with application-based intervention was more effective in enhancing understanding and improving respondents' knowledge than the provision of direct information alone (Table 2).

Table 2. Analysis of Differences in Knowlwdgw Before and After Combined Interventions.

Group	Pre-test Median (IQR)	Post-test 3 Median (IQR)	Z	*r*	*p*
Combined MI	4 (3-5)	8 (7-9)	-6.15		<0.001
Face-toFace MI	5 (4-6)	7 (6-8)	-5.00		0.003

* $p < 0.05$ indicates statistical significance.

 doi:10.20944/preprints202603.2484.v1

3.3. Analysis of Differences in Tooth Brushing Behavior (Tooth Brush Practice) Before and After Intervention

Both groups demonstrated significant improvements in tooth-brushing behavior after the four-month intervention period ($p < 0.05$), as shown in Table 2. The combined MI group exhibited a larger median increase compared to the face-to-face MI group, suggesting that digital follow-up support contributed to sustained behavioral change (Table 3).

Table 3. Analysis of differences in tooth brushing behavior in adolescents who were given MI in combination (face to face and during) with MI given face to face.

Group	Pre-test Median (IQR)	Post-test 3 Median (IQR)	Z	*p*
Combined MI	10 (8-12)	15 (14-16)	-6.17	<0.001
Face-toFace MI	12 (10-13)	13 (12-14)	-3.16	0.003

* $p < 0.05$ indicates statistical significance.

3.4. Analysis of Differences in OHIS status Before and After Intervention

OHI-S scores significantly decreased in both groups, indicating improved oral hygiene status ($p < 0.05$). The reduction was more pronounced in the combined MI group, reflecting a greater clinical improvement in plaque and debris control among adolescents who received both face-to-face and application-based MI support. Negative median change values indicate a reduction in OHI-S scores, reflecting improvement in oral hygiene status (Table 4).

Table 4. Analysis of differences in tooth brushing behavior in adolescents who were given MI in combination (face to face and during) with MI given face to face.

Group	Pre-test Median (IQR)	Post-test 3 Median (IQR)	Z	*p*
Combined MI	3.2 (2.4-3.8)	1.4 (1.0-2.0)	-6.03	<0.001
Face-toFace MI	2.8 (2.0-3.5)	2.0 (1.5-2.8)	-3.48	0.003

* $p < 0.05$ indicates statistical significance.

4. Discussion

4.1. Analysis of differences in Knowledge of MI interventions face to face with a combination (face to face with during)

The results of this study indicate that Motivational Interviewing (MI) interventions delivered in combination through face-to-face and during sessions significantly increased respondents' knowledge. The consistent increase in mean knowledge scores at each measurement stage reflects the effectiveness of this approach in strengthening participants' understanding [32,33]. This finding aligns with numerous studies that emphasize the superiority of MI, particularly when combined with interactive methods such as face-to-face sessions. Lundahl et al. (2010), through their meta-analysis, emphasized that MI is highly effective in various contexts, particularly when conducted in direct interaction, as it can optimally increase participant motivation and engagement [34].

Furthermore, research by Baer et al. supports these findings by showing that face-to-face sessions not only increase knowledge but also strengthen participant engagement in the behavior change process. High engagement in face-to-face sessions is believed to create a more interactive discussion atmosphere, allowing participants to better understand the material presented and express questions or concerns directly. On the other hand, the group that received only the during intervention without MI also experienced an increase in knowledge, although the magnitude of the change was much smaller [35]. This illustrates that while digital media or during can be an effective and flexible learning tool, the presence of a face-to-face component still plays a crucial role in optimizing the knowledge-building process. A study conducted in *the Journal of Medical Internet*

 doi:10.20944/preprints202603.2484.v1

Research (JMIR) supports this conclusion by showing that digital-based MI is indeed effective, but the intensity and quality of behavior change tend to be greater in interventions involving face-to-face interaction.

Overall, the results of this study emphasize the importance of integrating face-to-face and in-person approaches in implementing MI-based interventions. This combined approach not only significantly improves knowledge but also strengthens participants' engagement and motivation in the learning process. Therefore, to achieve optimal results, it is recommended that health education interventions or other behavioral training utilize a blended strategy, combining face-to-face sessions with reinforcement through digital media or during the process. This approach has been shown to be more effective than relying solely on one method, as supported by findings from various studies published in reputable international journals.

4.2. Analysis of Differences in Tooth Brushing Behavior (Tooth Brush Practice) Before and After Intervention

The results of this study confirm that Motivational Interviewing (MI) interventions delivered in combination—both face-to-face and during sessions—have a significant impact on improving tooth-brushing behavior in adolescents. The significant increase in average behavior in this group indicates that intervention methods involving direct interaction and continuous reinforcement throughout the intervention process are able to encourage more optimal behavior change [36–39]. These findings align with international studies that suggest that MI, particularly in combined or blended models, is highly effective in modifying health behaviors in adolescents, including oral hygiene practices.

Research by Freudenthal & Bowen (2020) in *the Journal of Dental Research* showed that adolescents who received in-person MI intervention with digital support or regular reinforcement tended to maintain behavioral changes better than those who received only traditional education. Face-to-face interactions provide facilitators with the opportunity to build more personal relationships, motivate participants, and tailor messages to individual needs, while reinforcement throughout the process helps ensure messages are remembered and implemented [40–42].

Meanwhile, the group receiving only face-to-face intervention without MI elements also experienced an increase in toothbrushing behavior, although the magnitude of the change was not as large as the combined MI group. This suggests that face-to-face education is indeed effective in increasing knowledge and behavior, but not optimal in facilitating sustainable behavior change. A study in *the Journal of Medical Internet Research* (JMIR) also reported that the MI approach combined with other methods is superior in internalizing healthy behaviors, as it can increase participants' self-efficacy and commitment to change [43–45].

Overall, these results confirm that intervention strategies combining MI with face-to-face and during-the-hour approaches are more effective in establishing and maintaining healthy behaviors in adolescents, particularly tooth brushing behavior. Integrating these two methods not only increases the effectiveness of the intervention but also provides a more holistic and sustainable learning experience for participants. Therefore, the combined implementation of MI is recommended for adolescent health education programs to achieve more significant and sustainable behavior change.

4.3. Analysis of Differences in OHIS status Before and After Intervention

These findings reinforce previous research showing that a multimodal approach to health interventions, particularly utilizing digital technology as a support, can increase the effectiveness of behavior change. Studies published in the Journal of Medical Internet Research (JMIR) and Patient Education and Counseling confirm that integrating MI with online support—such as app reinforcement, reminder messages, or online education—can extend the duration of intervention effects, improve information retention, and make it easier for participants to incorporate health practices into their daily lives [46–49]. Furthermore, the use of digital technology in health intervention programs facilitates more flexible and continuous access to information. This allows adolescents to receive ongoing motivation and reminders outside of face-to-face sessions, resulting in more consistent and sustainable behavior change. Other studies have also shown that adolescents

 doi:10.20944/preprints202603.2484.v1

tend to be more responsive to interactive, technology-based approaches, which can increase engagement and self-efficacy in maintaining oral hygiene [50–53].

Although no statistically significant baseline differences were identified, small variations in median scores were observed, particularly in knowledge, tooth-brushing behavior, and OHI-S scores. These differences may have influenced the magnitude of change observed after the intervention. Therefore, the findings should be interpreted with caution

Overall, the results of this study emphasize the importance of adopting intervention strategies that integrate face-to-face and online methods in health behavior change efforts. This approach not only increases the effectiveness of interventions but also provides more adaptive and relevant experiences for adolescents in the digital age. Therefore, the combined use of MI can be recommended as an effective strategy in oral health education programs for adolescents, to encourage better and more sustainable tooth brushing behaviors

5. Conclusions

The implementation of app-based motivational interviewing (MI) counseling was associated with improvements in the dental and oral health status of adolescents in Gorontalo City. The integration of digital technology into MI interventions may enhance motivation and engagement in promoting oral health behaviors. However, these findings should be interpreted with caution due to the quasi-experimental design, potential baseline differences, and the lack of longitudinal analytical approaches. Therefore, the results reflect associations rather than definitive causal effects. Despite these limitations, the integration of app-based MI shows potential as an innovative approach to support oral health promotion among adolescents. Further studies using more rigorous designs are needed to confirm its effectiveness and long-term impact.

Study Limitations

This study has several limitations that should be considered when interpreting the findings. First, the quasi-experimental design without randomization, including the allocation of participants based on school clusters, introduces a potential risk of selection bias and limits the ability to establish causal relationships between the intervention and outcomes. Differences in underlying characteristics between groups may have influenced the results.

Second, the sample was drawn from a single geographic area, which may restrict the generalizability of the findings to adolescents in other regions or settings. Third, although multiple follow-up measurements were conducted, the study did not apply longitudinal analytical approaches to fully assess changes across time points, limiting the ability to draw firm conclusions regarding sustained behavioral change. In addition, the relatively short follow-up period further restricts the evaluation of long-term effects.

Furthermore, the assessment of tooth-brushing behavior relied partly on self-reported measures, which may be subject to reporting bias. Finally, the individual contribution of each intervention component (face-to-face MI and application-based MI) could not be isolated in this study.

Therefore, the findings should be interpreted with caution. Future studies using randomized controlled designs, larger and more diverse samples, longer follow-up periods, and more robust longitudinal analytical methods are recommended to strengthen the evidence base.

Author Contributions: All authors contributed substantially to the conception, design, data collection, analysis, and interpretation of the research. D.I.K: Conceptualization, Formal analysis, Investigation, Methodology, Project Administration, Resources, Visualisation, Writing – original draft, Writing – review & editing. A.I.A: Supervision, Writing – review & editing. I.N.A: Supervision, Writing – review & editing. I.S: Writing – review & editing, A.A: Writing – review & editing, I.F.I: Writing – review & editing, N.H: Writing – review & editing, I: Methodology, Writing – orginal draft, Writing – review & editing. All authors read and approved the final manuscript.

Funding: This research received no external funding

 doi:10.20944/preprints202603.2484.v1

Institutional Review Board Statement: The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request. Data sharing complies with ethical restrictions set by the Research Ethics Committee of Hasanuddin University. Ethics Approval Number: 046/KEPK FKG-RSGMP UH/EE/XI/2024. Approval Date: 13 November 2024.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patients to publish this paper. In addition to parental consent, verbal assent was obtained from participating children prior to data collection.

Data Availability Statement: The data underlying this study cannot be made publicly available due to ethical considerations related to the protection of adolescent participants' personal information. Anonymized data may be provided by the corresponding author upon reasonable request and subject to approval from the relevant ethics and institutional review boards.

Acknowledgments: The authors wish to express their sincere gratitude to the Faculty of Dentistry, Hasanuddin University, for providing academic and logistical support during this research. The authors deeply appreciate the participation of all teachers, students, and parents who generously contributed their time and cooperation throughout the study.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

OHI-S	Oral Hygiene Index Status
MI	Motivational Interview

References

1. Lipsky MS, Singh T, Zakeri G, Hung M. Oral Health and Older Adults: A Narrative Review. Dent J (Basel). 2024 Feb 1;12(2):30. doi:10.3390/dj12020030
2. Aida J. Oral Health and Nutrition: Epidemiology, Clinical, and Social Aspects. J Nutr Sci Vitaminol (Tokyo). 2022 Nov 30;68(Supplement):S26–7. doi:10.3177/jnsv.68.S26
3. Pretty N, Ganapathy D, Sasanka LK. Impact of Brushing Teeth at Night Before Sleep. International Journal of Pharmaceutical Research. 2020 Sep 2;12(04). doi:10.31838/ijpr/2020.12.04.332
4. Hodzic B. The state of oral health and its impact on the quality of life of six-year-olds in the city area of Živinice. Acta Medica Saliniana. 2024 Jan 15;53(2). doi:10.5457/ams.v53i2.675
5. Alpert PT. Oral Health. Home Health Care Manag Pract. 2017 Feb 9;29(1):56–9. doi:10.1177/1084822316651658
6. Merza R fouad, Aljohani RB, Alqahtani NS, Al-sulami SBB, Sindi J abid, Kabli R sadiq yousif, et al. Oral Health and Systemic Disease: A Systematic Review of the Impact of Dental Care on Overall Health. Journal of Ecohumanism. 2024 Nov 11;3(7). doi:10.62754/joe.v3i7.4679
7. Anwar AI, Panna SS, Katili DI, Irwan I, Julianto E. Analysis of the Phobia of Brushing Teeth in High School Students in Palopo City, Indonesia During COVID-19. Pesqui Bras Odontopediatria Clin Integr. 2024;24. doi:10.1590/pboci.2024.076
8. Haryani W, Sulistiawati D, Yuniarly E, A'yun Q, Purnama T. Dentalmetric Application to Detect Quality of Life Related to Oral Health (OHRQoL) in Adolescents. Journal of International Dental and Medical Research [Internet]. 2024;17(3):1187 – 1191. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85206079749&partnerID=40&md5=eb31213af34be40d5419e79598131307
9. Puteri WC, Ruata ANA, Ananda GC, Panama MGS, Puspitaningrum martining S, waskita FA, et al. Literacy Level on Dental and Oral Health in Health Students (Non Dentisty). Indian Journal of Forensic Medicine & Toxicology. 2020 Oct 7. doi:10.37506/ijfmt.v14i4.12275

 doi:10.20944/preprints202603.2484.v1

10. Mamani SJT, Mukamurigo J, Uwambaye P, Andegiorgish AK. Prevalence of dental caries and associated factors among secondary school students in Kigali, Rwanda: a cross-sectional study. BMC Oral Health. 2025 Feb 22;25(1):285. doi:10.1186/s12903-025-05604-3
11. Xavier A, Carvalho ÉS de, Bastos R da S, Caldana M de L, Damiance PRM, Bastos JR de M. Impact of dental caries on quality of life of adolescents according to access to oral health services: a cross sectional study. Braz J Oral Sci. 2016 Oct 13;15(1):1. doi:10.20396/bjos.v15i1.8647090
12. Sadjadpour F, Hosseinichimeh N, Pahel BT, Metcalf SS. Systems mapping of multilevel factors contributing to dental caries in adolescents. Frontiers in Oral Health. 2024 Jan 31;4. doi:10.3389/froh.2023.1285347
13. Vats S, Gupta R, Gupta BD, Chaudhary S, Bhargava A, Sharma D. Determining the influence of oral hygiene practices and diet on dental caries among 15-year-old adolescents of Loni block, Ghaziabad- A cross-sectional study. Journal of Dental Specialities. 2024 Sep 28;12(2):131–7. doi:10.18231/j.jds.2024.024
14. Morales-Valenzuela AA, Salmerón-Valdés EN, Zuluaga-Morales JS, Serrano-Plata M de J, Moustafa WHH, Velázquez-Enriquez U, et al. Dietary habits that affect the caries experience in Mexican adolescents. An odds ratio study. Journal of Clinical Pediatric Dentistry. 2025;49(4):41. doi:10.22514/jocpd.2025.074
15. Lelyana N, Sarjito A, Sutawidjaya AH. The Effectiveness of Dental Health Education Programs in Reducing Dental Caries Prevalence among Indonesian Adolescents. Journal of Ecohumanism. 2024 Oct 18;3(7):2140–52. doi:10.62754/joe.v3i7.4368
16. Anggina DN, Asmalia R. The Influence of Dental Health Education on the Gingival Health of Students at STIKES Muhammadiyah Palembang. Indian J Public Health Res Dev. 2019;10(7):987. doi:10.5958/0976-5506.2019.01707.8
17. Shetty V, Kamath N, Rai K, Hegde A, Suresh LR, Shenoy V. Exploring the Effect of Caregiver Dental Health Education on the Oral Health of Children with Disabilities over 6 Months: A Mixed-methods Study. World Journal of Dentistry. 2025 Feb 8;15(11):917–24. doi:10.5005/jp-journals-10015-2532
18. Haque SE, Rahman M, Itsuko K, Mutahara M, Kayako S, Tsutsumi A, et al. Effect of a school-based oral health education in preventing untreated dental caries and increasing knowledge, attitude, and practices among adolescents in Bangladesh. BMC Oral Health. 2016 Dec 25;16(1):44. doi:10.1186/s12903-016-0202-3
19. Zargar M, Namdari M, Sadeghipour M, Mozhdehifard M, Khoshnevisan MH. Key Determinants of Oral and Dental Health Promotion in 6-12 years old Primary School Children: A Comprehensive Overview. Journal of Contemporary Medical Sciences. 2025 Feb 26;11(1). doi:10.22317/jcms.v11i1.1685
20. Gillam DG, Yusuf H. Brief Motivational Interviewing in Dental Practice. Dent J (Basel). 2019 May 1;7(2):51. doi:10.3390/dj7020051
21. Centis E, Petroni ML, Ghirelli V, Cioni M, Navacchia P, Guberti E, et al. Motivational Interviewing Adapted to Group Setting for the Treatment of Relapse in the Behavioral Therapy of Obesity. A Clinical Audit. Nutrients. 2020 Dec 18;12(12):3881. doi:10.3390/nu12123881
22. Zhang M, Lan J, Zhang T, Sun W, Liu P, Wang Z. Oral health and caries/gingivitis-associated factors of adolescents aged 12–15 in Shandong province, China: a cross-sectional Oral Health Survey. BMC Oral Health. 2021 Dec 5;21(1):288. doi:10.1186/s12903-021-01640-x
23. Barahona-Cubillo JB, Rojas-Brenes C, Sánchez-Achío T, Stradi-Granados S, Barboza-Solís C. Prevalence of Tooth Loss, Bleeding on Probing and Malocclusion as Oral Disease Indicators in Costa Rican Male Adolescents: a Cross Sectional Study. Odovtos - International Journal of Dental Sciences. 2022 Jul 19;465–79. doi:10.15517/ijds.2022.51871
24. Firmino RT, Granville-Garcia AF, Paiva SM, Campos PH de, Oliveira AV, Diniz MB. Shame from Smiling and Speaking Due to Oral Health Problems in Brazilian Adolescents: A Nationwide Population-Based Study. Pesqui Bras Odontopediatria Clin Integr. 2022;22. doi:10.1590/pboci.2022.068
25. Simangwa LD, Åstrøm AN, Johansson A, Minja IK, Johansson AK. Oral diseases and oral health related behaviors in adolescents living in Maasai population areas of Tanzania: a cross-sectional study. BMC Pediatr. 2019 Dec 7;19(1):275. doi:10.1186/s12887-019-1655-8
26. Su S, Zhang J, Deng R, Wang W, Cui T, Su Y, et al. Oral health status and associated factors among 12 to 15-year-old Chinese adolescents in Southeast China: A cross-sectional study. Medicine. 2024 Jan 26;103(4):e37080. doi:10.1097/MD.0000000000037080

 doi:10.20944/preprints202603.2484.v1

27. Galicia-Diez Barroso D, Abeijón-Malvaez LD, Moreno Altamirano GA, Irigoyen-Camacho MEJ, Finlayson TL, Borges-Yáñez SA. Using the Expanded Andersen Model to Determine Factors Associated with Mexican Adolescents' Utilization of Dental Services. Healthcare. 2023 Dec 13;11(24):3159. doi:10.3390/healthcare11243159
28. Pedamallu H, Ehrhardt MJ, Maki J, Carcone AI, Hudson MM, Waters EA. Technology-Delivered Adaptations of Motivational Interviewing for the Prevention and Management of Chronic Diseases: Scoping Review. J Med Internet Res. 2022 Aug 9;24(8):e35283. doi:10.2196/35283
29. Murariu A, Bobu L, Geleţu GL, Stoleriu S, Iovan G, Vasluianu RI, et al. The Impact of Mobile Applications on Improving Oral Hygiene Knowledge and Skills of Adolescents: A Scoping Review. J Clin Med. 2025 Apr 23;14(9):2907. doi:10.3390/jcm14092907
30. Aiman H, Kilgariff JK, Marks D, Albiston M. Does motivational interviewing have a role in dentistry? Br Dent J. 2025 Feb 14;238(3):166–71. doi:10.1038/s41415-025-8319-x
31. Arayasirikul S, Turner C, Trujillo D, Le V, Beltran T, Wilson EC. Does the Use of Motivational Interviewing Skills Promote Change Talk Among Young People Living With HIV in a Digital HIV Care Navigation Text Messaging Intervention? Health Promot Pract. 2020 Sep 6;21(5):738–43. doi:10.1177/1524839920936246
32. Fortune J, Breckon J, Norris M, Eva G, Frater T. Motivational interviewing training for physiotherapy and occupational therapy students: Effect on confidence, knowledge and skills. Patient Educ Couns. 2019 Apr;102(4):694–700. doi:10.1016/j.pec.2018.11.014
33. Zhu S, Sinha D, Kirk M, Michalopoulou M, Hajizadeh A, Wren G, et al. Effectiveness of behavioural interventions with motivational interviewing on physical activity outcomes in adults: systematic review and meta-analysis. BMJ. 2024 Jul 10;386:e078713. doi:10.1136/bmj-2023-078713
34. Lundahl BW, Kunz C, Brownell C, Tollefson D, Burke BL. A Meta-Analysis of Motivational Interviewing: Twenty-Five Years of Empirical Studies. Res Soc Work Pract. 2010 Mar 11;20(2):137–60. doi:10.1177/1049731509347850
35. Gabarda A, Butterworth S, Liang Q, Beckjord E. Pilot Study of a Motivational Interviewing Training on Practitioners' Skill Set for Patient Centered Communication. American Journal of Health Promotion. 2023 Nov 26;37(8):1070–7. doi:10.1177/08901171231191130
36. Wu L, Gao X, Lo ECM, Ho SMY, McGrath C, Wong MCM. Motivational Interviewing to Promote Oral Health in Adolescents. Journal of Adolescent Health. 2017 Sep;61(3):378–84. doi:10.1016/j.jadohealth.2017.03.010
37. Wu L, Lo ECM, McGrath C, Wong MCM, Ho SMY, Gao X. Motivational interviewing for caries prevention in adolescents: a randomized controlled trial. Clin Oral Investig. 2022 Jan 13;26(1):585–94. doi:10.1007/s00784-021-04037-w
38. Watt SB, Marshman Z. Can motivational interviewing help prevent dental caries in secondary school children? Evid Based Dent. 2022 Jun 24;23(2):56–7. doi:10.1038/s41432-022-0261-z
39. Marshman Z, El-Yousfi S, Kellar I, Dey D, Robertson M, Day P, et al. Development of a secondary school-based digital behaviour change intervention to improve tooth brushing. BMC Oral Health. 2021 Dec 22;21(1):546. doi:10.1186/s12903-021-01907-3
40. Feldstein Ewing S, Bryan AD, Dash GF, Lovejoy TI, Borsari B, Schmiege SJ. Randomized controlled trial of motivational interviewing for alcohol and cannabis use within a predominantly Hispanic adolescent sample. Exp Clin Psychopharmacol. 2022 Jun;30(3):287–99. doi:10.1037/pha0000445
41. Stewart DG, Felleman BI, Arger CA. Effectiveness of Motivational Incentives for Adolescent Marijuana Users in a School-Based Intervention. J Subst Abuse Treat. 2015 Nov;58:43–50. doi:10.1016/j.jsat.2015.06.002
42. Stonbraker S, Haight E, Lopez A, Guijosa L, Davison E, Bushley D, et al. Digital Educational Support Groups Administered through WhatsApp Messenger Improve Health-Related Knowledge and Health Behaviors of New Adolescent Mothers in the Dominican Republic: A Multi-Method Study. Informatics. 2020 Nov 5;7(4):51. doi:10.3390/informatics7040051
43. Bouwman EP, Onwezen MC, Taufik D, de Buisonjé D, Ronteltap A. Brief self-efficacy interventions to increase healthy dietary behaviours: evidence from two randomized controlled trials. British Food Journal. 2020 Jul 8;122(11):3297–311. doi:10.1108/BFJ-07-2019-0529

 doi:10.20944/preprints202603.2484.v1

44. Curtin S, Trace A, Ziada H, Crowley E. Motivational interviewing for dental clinicians. J Ir Dent Assoc [Internet]. 2014;60(1):35 – 37. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84899425070&partnerID=40&md5=f1e375f614a566790b48472bc5109ca4
45. Gonzalez J, Brickhouse TH, Carrico CK, Jayaraman J. Effect of motivational interviewing on preventive strategies for children receiving full-mouth dental rehabilitation under general anesthesia: A randomized controlled trial. Int J Paediatr Dent. 2025 Mar 16;35(2):259–67. doi:10.1111/ipd.13228
46. Miller WR, Rollnick S. Motivational Interviewing: Helping people change (3rd ed.). 2013.
47. Bean MK, Thornton LM, Jeffers AJ, Gow RW, Mazzeo SE. Impact of motivational interviewing on engagement in a parent-exclusive paediatric obesity intervention: randomized controlled trial of NOURISH+MI. Pediatr Obes. 2019 Apr 4;14(4). doi:10.1111/ijpo.12484
48. Jake-Schoffman DE, Brown SD, Baiocchi M, Bibeau JL, Daubenmier J, Ferrara A, et al. Methods-Motivational Interviewing Approach for Enhanced Retention and Attendance. Am J Prev Med. 2021 Oct;61(4):606–17. doi:10.1016/j.amepre.2021.04.005
49. Galvão Gomes da Silva J, Kavanagh DJ, Belpaeme T, Taylor L, Beeson K, Andrade J. Experiences of a Motivational Interview Delivered by a Robot: Qualitative Study. J Med Internet Res. 2018 May 3;20(5):e116. doi:10.2196/jmir.7737
50. Gee B, Teague B, Farrar M, Farrar V, Szinay D, Chan LF, et al. Exploring the Use of Digital Technology to Support Health Behavior Change in Young People Under the Care of Complications of Excess Weight (CCEW) Clinics: Qualitative Patient-Centered Design Study. JMIR Form Res. 2025 Oct 15;9:e64947. doi:10.2196/64947
51. Partridge SR, Redfern J. Strategies to Engage Adolescents in Digital Health Interventions for Obesity Prevention and Management. Healthcare. 2018 Jun 21;6(3):70. doi:10.3390/healthcare6030070
52. Marashi SZ, Hidarnia A, Kazemi SS, Shakerinejad G. The effect of educational intervention based on self-efficacy theory on promoting adolescent oral health behaviors through mobile application: a randomized controlled trial study. BMC Oral Health. 2024 Oct 24;24(1):1283. doi:10.1186/s12903-024-04970-8
53. Bakhtiar M, Hosseini SM, Behbahanirad A, Kamyab A, Khani Jeihooni A. Preparation and evaluation of a multimedia oral health education software for teenagers. BMC Oral Health. 2025 May 12;25(1):712. doi:10.1186/s12903-025-06083-2