

**EVALUATING THE IMPACT OF PUPPET SHOW–BASED ORAL HEALTH EDUCATION ON KNOWLEDGE, ATTITUDES AND PRACTICES AMONG CHILDREN AGED 5 TO 12 YEARS**

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Background/ Objective: Oral diseases in early childhood are often linked to poor hygiene practices and limited awareness. This study aimed to assess the effectiveness of a puppet show–based educational intervention in improving oral health knowledge, attitudes, and practices among pediatric patients.

Methods: A pre-post-follow-up design was implemented with 60 children (aged 5–12) visiting a pediatric OPD in a dental college located in Bhubaneswar, Odisha. A structured KAP questionnaire assessed knowledge (10 items), attitudes (5-point Likert scale), and self-reported practices at three intervals: baseline, immediately post-intervention, and four-week follow-up. A 30-minute puppet show focused on brushing, diet, and dental visits. Data was analyzed using paired t-tests and repeated-measures ANOVA ($p < 0.05$).

Results: Slight improvements were noted post-intervention: mean knowledge scores rose from 6.18 ± 1.25 to 6.23 ± 1.14 ; attitude scores increased from 4.06 ± 1.11 to 4.08 ± 1.20 ; and practice scores from 5.12 ± 1.09 to 5.17 ± 1.04 . However, these differences were not statistically significant ($p = 0.437$ for knowledge, $p = 0.852$ for attitude, $p = 0.462$ for practice), indicating limited short-term effect.

Conclusion: The intervention yielded modest, non-significant improvements. Repeated or multi-modal approaches may be necessary to elicit meaningful, lasting behavioral changes in children's oral health.

Keywords: Dental health literacy; Knowledge, Attitude, Practice (KAP); Puppet show; Oral health education; Pediatrics dentistry.

1. INTRODUCTION

Oral diseases, particularly dental caries, remain among the most prevalent non-communicable diseases globally, disproportionately affecting pediatric populations in low- and middle-income countries¹. According to the World Health Organization (2022), approximately 3.7 billion individuals worldwide are impacted by oral health conditions, with children representing a significant at-risk demographic². Dental caries, if left untreated, can lead to chronic pain, infections, nutritional deficiencies, impaired speech development, and frequent school absenteeism, collectively impairing the child's overall health and psychosocial development.

The etiology of poor oral health in children is multifactorial, encompassing inadequate oral hygiene practices, high sugar consumption, and limited access to preventive dental care³. Moreover, a critical barrier to effective oral disease prevention is the lack of appropriate health education tailored to the cognitive and emotional developmental stage of children⁴. Conventional educational strategies such as lectures, posters, and brochures often fall short in engaging younger audiences and sustaining behavior changes due to their passive and didactic nature⁵.

Behavioral theories, including *Social Learning Theory* and the *Theory of Planned Behavior*, emphasize the role of interactive, observational learning and reinforcement in shaping health-related behaviors⁶. Within pediatric populations, education strategies that incorporate narrative structures, dramatization, and play-based learning have demonstrated improved outcomes in knowledge retention, motivation, and behavioral compliance⁷. Puppetry, as a dynamic and visually stimulating educational medium, offers an effective platform for delivering health messages in a format that resonates with children⁸. By modeling ideal behaviors in relatable scenarios, puppet-based interventions have the potential to promote favorable shifts in both cognitive understanding and attitudinal disposition towards oral hygiene⁹.

Existing literature supports the utility of puppet shows in school- and community-based settings for enhancing health awareness. For instance, Ladera et al., (2022) demonstrated that puppet theater significantly improved oral health knowledge and hygiene practices among Peruvian preschoolers¹⁰. Similarly, Asrori et al., (2025) reported that puppetry served as an effective pedagogical tool in modifying oral health behaviors among primary school children¹¹. However, there remains a paucity of evidence evaluating their application within clinical dental settings, particularly in the Indian context¹². Furthermore, limited research exists on the sustained impact of such interventions on both knowledge and attitudes when assessed longitudinally.

Therefore, this study seeks to evaluate the effectiveness of a puppet show-based oral health education intervention in enhancing oral health-related knowledge and attitudes among pediatric dental outpatients. Employing a Knowledge, Attitude, and Practice (KAP) framework

within a quasi-experimental pre-test-post-test design, the study investigates both the immediate and short-term impacts of the intervention on the target population.

2. MATERIALS AND METHODS

2.1 Study Design

This study employed a quasi-experimental, pre-post-test design without a control group to assess the effectiveness of a puppet show-based oral health education intervention. The study was conducted in the pediatric department of a dental college located in Bhubaneswar, Odisha, India, over a two-month period (March to May 2025).

2.2 Study Population

Children aged 5–12 years visiting the pediatric department for routine check-ups were considered for inclusion. Eligible participants were those accompanied by a consenting parent or guardian and with no prior exposure to structured oral health education programs. Children with developmental or cognitive disorders or those who had previously participated in oral health awareness activities were excluded to minimize bias. Of the 70 children assessed, 60 met the criteria and were enrolled using purposive sampling. The sample size was determined by moderate effect size, 80% statistical power, and a 5% significance level, with over-sampling to account for potential dropouts.

2.3 Questionnaire Tool

A standardized oral health questionnaire developed by WHO was employed to evaluate knowledge, attitudes, and practices related to oral hygiene among children. The tool comprised three sections with a total of 30 items. The knowledge component included 10 multiple-choice questions addressing key topics such as brushing techniques, fluoride use, dietary contributors to dental caries, and the importance of regular dental visits. Each correct response was scored as 1, while incorrect responses were scored as 0, resulting in a possible knowledge score ranging from 0 to 10¹³.

The attitude section consisted of 10 items with options ranging from “Strongly Disagree” (1) to “Strongly Agree” (5), yielding a total attitude score between 10 and 50. These items captured both affective and behavioral intentions toward oral hygiene practices^{14,15}. The third section, focused on actual oral hygiene behaviors, comprised 10 practice-related items that assessed brushing frequency, use of hygiene aids (e.g., toothbrush, floss, chewsticks), toothpaste type, dietary habits, dental visit regularity, and tobacco usage. Responses were captured using multiple-choice and frequency-based scales (e.g., “Never” to “Several times a day”), allowing ordinal-level analysis.

Data Collection Tools

Data was collected face-to-face using the structured questionnaire in a quiet and supervised area within the pediatric dental department. Tools were provided in the local language and explained by trained investigators. Each child completed the questionnaire individually, with support provided as needed, particularly for younger participants. Assessments were administered three times: before the intervention (Pre-test), immediately after the puppet show (Post-test 1), and four weeks later (Post-test 2), to evaluate immediate and retained impacts. All responses were recorded systematically.

2.4 Study Phases

The study was conducted in three structured phases to evaluate the effectiveness of the puppet show-based oral health education intervention:

- **Pre-Intervention (Baseline Assessment)**

At the outset, eligible participants and their parents were briefed about the study protocol. Informed written consent was obtained from the guardians, and verbal assent was taken from each child. Children then completed a baseline (pre-test) assessment comprising a structured questionnaire divided into three components: (i) a 10-item multiple-choice knowledge section, (ii) a 5-point Likert-scale-based attitude section, and (iii) a set of items assessing self-reported oral hygiene practices. The questionnaires were administered face-to-face in a quiet, supervised space within the pediatric dental clinic to ensure clarity and reduce distractions. Assistance was provided for younger children as required.

- **Intervention**

Following the pre-test, all participants attended a 30-minute puppet show-based oral health education session. The session was conducted in small groups in a designated child-friendly area of the department. The puppet show was collaboratively developed by pediatric dental professionals and puppeteer, focusing on essential oral health topics such as correct brushing techniques, the role of fluoride, dietary contributors to dental health, and the risks of tobacco use. The format used storytelling, visual humor, and age-appropriate characters to engage children actively. Participants were encouraged to interact during the show and mimic modeled health behaviors. The same health educator delivered all sessions using a standardized script to maintain consistency across groups.

- **Post-Intervention Assessment and Follow-Up**

Immediately after the intervention, children were administered the same knowledge, attitude, and practice questionnaires (Post-test 1) to assess short-term improvements. A follow-up assessment (Post-test 2) was conducted four weeks later during their scheduled clinic visit using the same instruments to evaluate retention of knowledge, attitude reinforcement, and sustained

behavioral change. All responses from both follow-up points were systematically recorded and prepared for statistical analysis.

2.5 Statistical Analysis

Data was entered and analyzed using IBM SPSS Statistics for Windows, Version 26.0. Descriptive statistics (means, frequencies, percentages, and standard deviations) were calculated to summarize demographic characteristics and outcome variables across time points. Paired sample t-tests were used to compare pre- and post-intervention knowledge and attitude scores. Additionally, repeated measures ANOVA were applied to examine longitudinal changes and assess the sustainability of the intervention's effects. All statistical tests were conducted at a significance threshold of $p < 0.05$, and assumptions of normality and sphericity were verified prior to parametric analyses.

3.RESULTS

A total of 70 children were initially screened for participation during the study period. Of these, 60 children who met the eligibility requirements were enrolled and completed the baseline (pre-test) assessment. All enrolled participants attended the puppet-show-based intervention and subsequently completed the immediate post-test evaluation. At the 4-week follow-up, outcome data was successfully collected from 56 participants, while four were lost to follow-up due to reasons such as school vacations and scheduling conflicts.

Demographic Characteristics

The average age of participants was 8.4 years (± 2.1), indicating a balanced representation of early and middle childhood. The gender distribution was slightly male-dominant (55% male, 45% female). In terms of socioeconomic status, 60% of children were from middle-income families and 40% from lower-income backgrounds, as assessed by the Modified Kuppuswamy Scale (Table 1).

Table 1. Demographic Characteristics of Participants

Characteristics	Values
Mean Age (years)	8.4 $\pm$ 2.1
Gender	
Male	55%
Female	45%
Socioeconomic Status	
Middle	60%
Lower	40%

3.1 Assessment of Oral Health Knowledge Among Pediatric Participants

3.2.1 Knowledge-based Questions

- **Self-Perception of Oral Health**

A modest improvement was noted in children's self-perception of oral health following the intervention in Table 2. The proportion of participants who rated their oral health as Excellent increased from 3.3% to 6.7%, while those selecting Good and Average also showed slight gains. Notably, the percentage of children who were unsure (Don't Know) decreased from 21.7% to 16.7%, suggesting improved self-awareness and confidence in evaluating their oral health. These shifts indicate a positive trend in subjective health perception, likely influenced by the educational content delivered through the puppet show.

Table 2. How would you describe the health of your teeth and gums?		
Responses	Pre N (%)	Post N (%)
Excellent	2 (3.3)	4 (6.7)
Very Good	12 (20.0)	8 (13.3)
Good	9 (15.0)	10 (16.7)
Average	8 (13.3)	10 (16.7)
Poor	8 (13.3)	10 (16.7)
Very Poor	8 (13.3)	8 (13.3)
Don't Know	13 (21.7)	10 (16.7)

Reason for Last Dental Visit

Following the intervention, a greater proportion of children reported visiting the dentist due to pain or oral discomfort, increasing from 20.0% to 28.3%, and for treatment or follow-up care, rising from 21.7% to 25%. In contrast, visits for routine check-ups decreased from 28.3% to 21.7%, possibly reflecting more accurate recognition of symptomatic dental issues. Additionally, the proportion of children uncertain about the reason for their last dental visit declined from 30.0% to 25%, indicating improved recall and awareness of dental care experiences in Table 3, which reflects a modest improvement in recall accuracy and contextual understanding of oral healthcare interactions.

Table 3. What was the reason for your last visit to the dentist?		
Responses	Pre-test N (%)	Post-test N (%)
Pain or trouble with teeth, gums or mouth	12 (20.0)	17 (28.3)
Treatment/follow up treatment	13 (21.7)	15 (25)
Routine checkup of teeth/ treatment	17 (28.3)	13 (21.7)
I don't know/ I don't remember	18 (30.0)	15 (25)

• Awareness about Fluoride Use

Post-intervention responses revealed minimal change in awareness regarding fluoride use in toothpaste showed in figure 1. The proportion of children reporting use of fluoride-containing toothpaste remained relatively stable, with a slight decline from 48.3% to 46.7%, while those indicating non-use increased marginally from 51.7% to 53.3%. These findings suggest that the intervention had limited impact on altering fluoride-related knowledge, highlighting a potential gap in message retention or clarity regarding the benefits and identification of fluoride in dental products.

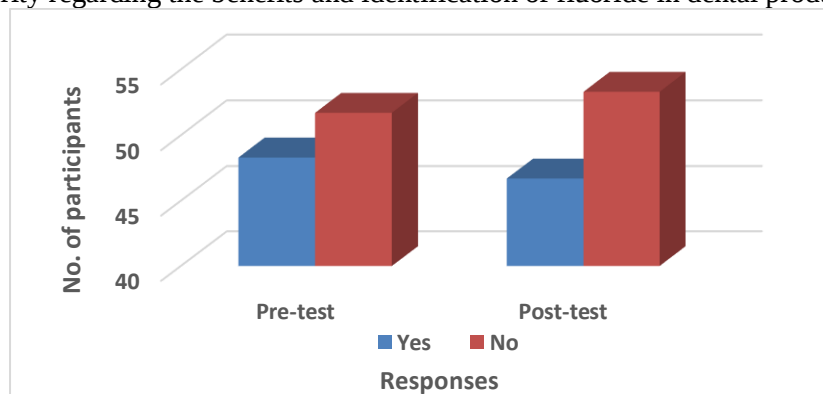


Figure 1. Do you use toothpaste that contains fluoride?

• Dietary Knowledge Related to Oral Health

Post-intervention data revealed a downward shift in the frequent consumption of cariogenic items. Daily intake of sugary foods such as chewing gum dropped from 23.3% to 13.3%, sweets/candy from 16.7% to 13.3%, and soft drinks from 21.7% to 13.3%. In contrast, healthier patterns emerged in the consumption of fresh fruit, with daily intake increasing from 10.0% to 11.7% and several times a day from 16.7% to 20.0%. These changes indicate an improvement in dietary awareness related to oral health, likely attributable to the intervention in Table 4.

Table 4. How often do you eat sugary foods/drinks like candy, soft drinks, or biscuits?

Responses	Pre-test N (%)						Post-test N (%)					
	Sever al times a day	Ever y day	Sever al times a week	Onc e a week	Once a mont h	Neve r	Sever al times a day	Ever y day	Sever al times a week	Onc e a week	Once a mont h	Neve r
Fresh fruit	10 (16.7)	6 (10)	9 (15)	12 (20)	13 (21.7)	10 (16.7)	12 (20)	7 (11.7)	7 (11.7)	12 (20)	12 (20)	10 (16.7)
Biscuits, cakes, cream cakes, sweet pies, buns etc.	12 (20)	9 (15)	14 (23.3)	13 (21.7)	4 (6.7)	8 (13)	8 (13.3)	9 (15)	15 (25)	14 (23.3)	3 (5)	11 (18.3)
Lemonade, Coca Cola, or other soft drinks	6 (10)	13 (21.7)	7 (11.7)	13 (21.7)	11 (18.3)	10 (16.7)	16 (26.7)	8 (13.3)	13 (21.7)	5 (8.3)	11 (18.3)	7 (11.7)
Jam/honey	10 (16.7)	10 (16.7)	9 (15)	12 (20)	9 (15)	10 (16.7)	11 (18.3)	13 (21.7)	10 (16.7)	8 (13.3)	9 (15)	9 (15)
Chewing gum containing sugar	14 (23.3)	10 (16.7)	4 (6.7)	8 (13.3)	14 (23.3)	10 (16.7)	8 (13.3)	9 (15)	8 (13.3)	13 (21.7)	12 (20)	10 (16.7)
Sweets/can dy	10 (16.7)	10 (16.7)	9 (15)	15 (25)	7 (11.7)	9 (15)	7 (11.7)	8 (13.3)	10 (16.7)	11 (18.3)	12 (20)	12 (20)
Milk with sugar	11 (18.3)	9 (15)	14 (23.3)	9 (15)	7 (11.7)	10 (16.7)	13 (21.7)	10 (16.7)	12 (20)	12 (20)	6 (10)	7 (11.7)
Tea with sugar	10 (16.7)	10 (16.7)	9 (15)	15 (25)	7 (11.7)	9 (15)	9 (15)	10 (16.7)	11 (18.3)	14 (23.)	10 (16.7)	6 (10)
Coffee with sugar	11 (18.3)	9 (15)	14 (23.3)	9 (15)	7 (11.7)	10 (16.7)	10 (16.7)	9 (15)	14 (23.3)	9 (15)	11 (18.3)	7 (11.7)
(Insert country- specific items)	9 (15)	10 (16.7)	10 (16.7)	14 (23.3)	12 (20)	5 (8.3)	12 (20)	14 (23.3)	8 (13.7)	8 (13.7)	10 (16.7)	8 (13.3)

• Dietary Knowledge Related to Oral Health

Awareness of tobacco's harmful effects on oral health demonstrated a modest shift following the intervention. The proportion of children recognizing its impact once a week increased notably from 8.3% to 23.3%, while higher-frequency responses such as every day and several times a week declined from 18.3% each to 15.0% and 10.0%, respectively. This redistribution suggests a refinement in understanding, with participants moving from vague or extreme responses toward more realistic acknowledgment of exposure risk, indicating improved but nuanced awareness post-intervention in Table 5.

Table 5. Can tobacco products harm your teeth and gums?		
Options/Responses	Pre-test N (%)	Post-test N (%)
Every day	11 (18.3)	9 (15)
Several times a week	11 (18.3)	6 (10)
Once a week	5 (8.3)	14 (23.3)
Several times a month	11 (18.3)	10 (16.7)
Seldom	13 (21.7)	12 (20)
Never	9 (15)	9 (15)

• Awareness Regarding Tobacco Effects

Knowledge of recommended brushing frequency showed slight variation post-intervention. Although the proportion of children selecting twice a day remained relatively low (13.3% pre to 11.7% post), there was a mild increase in those indicating once a day (13.3% to 15.0%) and only when they feel dirty (23.3% to 20.0%). However, the proportion of participants choosing never/I don't know remained unchanged at 18.3%, suggesting that while some improvement occurred, misconceptions and lack of clarity regarding optimal brushing habits persist. These findings highlight the need for reinforcing consistent oral hygiene messages found in Table 6.

Table 6. How often should teeth be brushed in a day?		
Responses	Pre-test N (%)	Post-test N (%)
Every day	10 (16.7)	7 (11.7)
Twice a day	8 (13.3)	9 (15)
Once a day	8 (13.3)	12 (20)
Only when they feel dirty	14 (23.3)	9 (15)
Seldom	12 (20)	11 (18.3)
Never / I don't know	8 (13.3)	11 (18.3)

• Knowledge of Oral Hygiene Practices

Post-intervention responses indicated improved understanding of oral hygiene practices, particularly regarding causes of dental caries showed in Table 7. Recognition of not brushing teeth properly as a very likely cause increased from 13.3% to 25.0%, while uncertainty (not sure) declined from 18.3% to 11.7%. For eating too many sweets, very likely responses decreased from 26.7% to 13.3%, but likely responses rose from 16.7% to 30.0%, suggesting a more realistic attribution. The perception of using too much toothpaste as a likely cause decreased slightly, with very likely responses dropping from 28.3% to 18.3%, indicating better differentiation between actual and perceived causes of cavities. These findings reflect enhanced knowledge and reduced misconceptions related to oral hygiene following the intervention.

Table 7: What do you think is the main reason people get cavities?										
Responses	Pre-test N (%)					Post-test N (%)				
	Very likely	Likely	Not sure	Unlikely	Very unlikely	Very likely	Likely	Not sure	Unlikely	Very unlikely
Eating too many sweets or sugary foods	16 (26.7)	10 (16.7)	9 (15)	15 (25)	10 (16.7)	8 (13.3)	18 (30)	15 (25)	9 (15)	10 (16.7)
Not brushing teeth properly	8 (13.3)	13 (21.7)	11 (18.3)	13 (21.7)	15 (25)	15 (25)	9 (15)	7 (11.7)	14 (23.3)	15 (25)
Not visiting the dentist	14 (23.3)	11 (18.3)	14 (23.3)	10 (16.7)	11 (18.3)	13 (21.7)	13 (21.7)	14 (23.3)	4 (6.7)	16 (26.7)
Using too much toothpaste	17 (28.3)	11 (18.3)	8 (13.3)	11 (18.3)	13 (21.7)	11 (18.3)	13 (21.7)	11 (18.3)	14 (23.3)	11 (18.3)

3.2 Assessment of Attitudes Toward Oral Health Among Pediatric Participants

• Self-Image and Social Perception

A moderate enhancement in self-perception was noted, with satisfaction regarding dental appearance rising from 30.0% to 35.0% post-intervention. Concurrently, dissatisfaction declined from 38.3% to 31.7%, indicating a shift in how children view their own teeth in figure 2. The proportion of uncertain responses remained nearly unchanged (31.7% to 33.3%), suggesting that while perceptions improved for some, further engagement may be needed to influence indecisive participants.

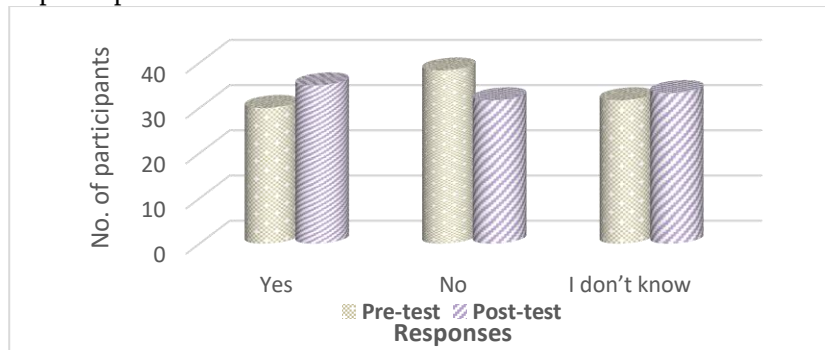


Figure 2: I am happy with the way my teeth look

Post-intervention responses showed minimal change in social confidence related to dental appearance. The proportion of children who reported feeling shy or embarrassed to smile rose slightly from 30.0% to 33.3%, while those who did not feel embarrassed declined marginally from 35.0% to 31.7%. Notably, the percentage of uncertain responses remained constant at 35.0%, indicating that despite the intervention, attitudes related to self-consciousness and social perception may require deeper behavioral engagement to shift meaningfully in figure 3.

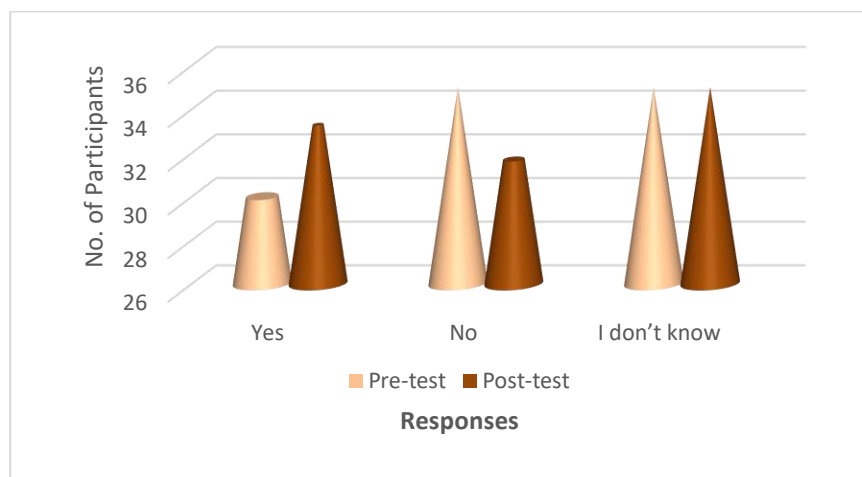


Figure 3. I feel shy or embarrassed to smile because of my teeth

• Perceived Importance of Oral Hygiene

Attitudinal responses toward the importance of dental visits revealed limited positive movement. The proportion of children who strongly agreed remained unchanged at 21.7%, while those who agreed slightly declined from 20.0% to 16.7%. A decrease in not sure responses (31.7% to 26.7%) indicates some gain in decisiveness; however, an increase in strongly disagreeing responses from 11.7% to 18.3% suggests persistent skepticism among a subset of participants in Table 8a. Overall, the intervention had a mixed impact on reinforcing the perceived necessity of routine dental care.

The belief that daily brushing is essential showed mixed outcomes. While the proportion of children who disagreed declined from 28.3% to 18.3%, the number of strongly disagree responses notably increased from 13.3% to 28.3%, suggesting a potential polarization of opinion. Meanwhile, strongly agree responses slightly decreased from 23.3% to 20.0%, and agree responses dropped from 20.0% to 18.3%. The unchanged proportion of not sure responses (15.0%) further points to limited improvement in consensus. These findings indicate that while some misconceptions may have been addressed, the message regarding the importance of daily brushing may not have been uniformly internalized in Table 8b.

Table 8. Attitudinal responses toward oral hygiene

Questions /Responses	Pre-test N (%)					Post-test N (%)				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
(a) Going to the dentist is important to keep teeth healthy	13 (21.7)	12 (20.0)	19 (31.7)	9 (15.0)	7 (11.7)	13 (21.7)	10 (16.7)	16 (26.7)	10 (16.7)	11 (18.3)
(b) I believe brushing teeth every day is necessary	14 (23.3)	12 (20.0)	9 (15.0)	17 (28.3)	8 (13.3)	12 (20.0)	11 (18.3)	9 (15.0)	11 (18.3)	17 (28.3)
(c) I feel that cleaning my teeth is boring or unnecessary	12 (20.0)	14 (23.3)	15 (25.0)	8 (13.3)	11 (18.3)	13 (21.7)	12 (20.0)	11 (18.3)	9 (15)	15 (25)
(d) I worry that I might lose teeth if I don't take care of them	6 (10.0)	14 (23.3)	11 (18.3)	14 (23.3)	15 (25.0)	12 (20.0)	17 (28.3)	11 (18.3)	8 (13.3)	12 (20.0)

Perceptions regarding the necessity and engagement of tooth cleaning showed a moderate shift post-intervention. The proportion of children who strongly disagreed with the notion that cleaning teeth is boring or unnecessary increased from 18.3% to 25.0%, indicating a positive change in attitude toward accepting oral hygiene as an essential routine. Additionally, “Not Sure” responses declined from 25.0% to 18.3%, reflecting improved clarity in participants' views. On the other hand, the percentage of children who strongly agreed with the statement slightly increased from 20.0% to 21.7%, suggesting that a subset of children retained negative perceptions. These findings demonstrate partial improvement in motivation-related attitudes toward oral hygiene, though further engagement may be necessary to shift entrenched negative beliefs (Table 8c).

Perceptions surrounding the value of tooth cleaning showed a modest improvement post-intervention. Strongly disagree responses increased from 18.3% to 25.0%, indicating a growing number of children who rejected the idea that oral hygiene is boring or unnecessary. Meanwhile, not sure responses declined from 25.0% to 18.3%, suggesting improved clarity in attitudes. However, strongly agree responses also saw a slight rise from 20.0% to 21.7%, pointing to persistent ambivalence in a subset. Overall, the findings reflect a gradual but incomplete shift in attitude toward viewing tooth cleaning as a meaningful daily practice in Table 8d.

3.3 Assessment of Oral Hygiene Practices Among Participants

• Oral Hygiene Practices

Post-intervention data revealed a reduction in the proportion of children who never cleaned their teeth, decreasing from 25.0% to 11.7%, indicating a positive shift in basic oral hygiene engagement. However, there was also a decline in those reporting brushing once a day (18.3% to 10.0%) and two or more times a day (20.0% to 15.0%), suggesting inconsistencies in adopting recommended practices. Notably, more participants reported cleaning their teeth several times a month (8.3% to 16.7%) and once a week (13.3% to 25.0%), which, although improved from non-practice, still fall short of ideal frequency. These results point toward initial behavioral change but highlight the need for reinforcing sustained, routine oral hygiene practices in Table 9.

Table 9. How often do you clean your teeth?		
Responses	Pre-test N (%)	Post-test N (%)
Never	15 (25)	7 (11.7)
Several times a month (2-3) time	5 (8.3)	10 (16.7)
Once a week	8 (13.3)	15 (25)
Several times a week (2-6)	9 (15)	13 (21.7)
Once a day	11 (18.3)	6 (10)
2 or more times a day	12 (20.0)	9 (15)

Use of conventional cleaning aids showed mixed trends post-intervention. Toothbrush use increased from 13.3% to 21.7%, suggesting a positive shift toward standard oral hygiene tools in Table 10. However, reliance on traditional or non-standard methods remained notable. Use of charcoal doubled from 10.0% to 20.0%, and chewstick/miswak use also increased slightly (11.7% to 15.0%), indicating continued preference for indigenous practices. In contrast, the use of dental floss declined from 16.7% to 8.3%, reflecting limited uptake of recommended interdental cleaning. Overall, the findings suggest partial improvement in tool selection, with greater acceptance of toothbrushes but persistent gaps in comprehensive hygiene practices.

Table 10. Do you use any of the following to clean your teeth or gums?				
Responses	Pre-test N (%)		Post-test N (%)	
	Yes	No	Yes	No
Toothbrush	8 (13.3)	9 (15)	13 (21.7)	9 (15)
Wooden toothpicks	10 (16.7)	5 (8.3)	9 (15)	10 (16.7)
Plastic toothpicks	7 (11.7)	9 (15)	7 (11.7)	5 (8.3)
Thread (dental floss)	10 (16.7)	11 (18.3)	5 (8.3)	11 (18.3)
Charcoal	6 (10)	10 (16.7)	12 (20)	9 (15)
Chewstick/miswak	7 (11.7)	12 (20)	9 (15)	7 (11.7)
Other	12 (20)	4 (6.7)	5	9 (15)

A decline in toothpaste usage was observed following the intervention, with yes responses dropping from 66.7% to 56.7%, and no responses rising from 33.3% to 43.3%. This unexpected reversal suggests either a regression in practice adherence or potential confusion introduced during the intervention regarding appropriate oral cleaning materials. The results highlight a need to reinforce clear messaging about the role of fluoride toothpaste in effective oral hygiene in figure 4.

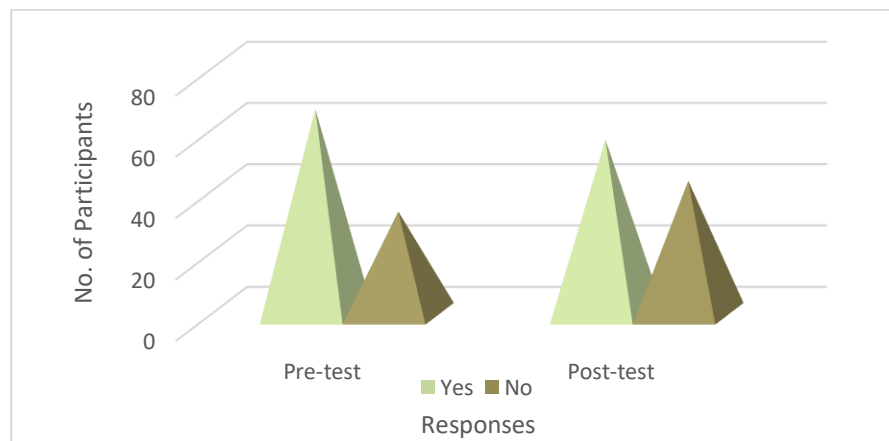


Figure 4. Do you use toothpaste to clean your teeth?

• Dental Service Utilization

Post-intervention trends in dental service utilization revealed mixed outcomes. While visits four times a year increased from 8.3% to 21.7%, suggesting improved engagement among some participants, there was also a rise in those reporting never visiting a dentist, from 6.7% to 15.0%, and those unsure of their visit history (10.0% to 11.7%). Additionally, the proportion of children who visited the dentist once, three times, or more than four times declined, indicating inconsistency in access or recall. These findings reflect partial improvement in routine utilization but also highlight disparities in awareness, recall, and access to dental care services that may require targeted follow-up in Table 11.

Table 11. How often did you go to the dentist in the past 12 months?		
Responses	Pre-test N (%)	Post-test N (%)
Once	10 (16.7)	7 (11.7)
Twice	7 (11.7)	7 (11.7)
Three times	10 (16.7)	6 (10)
Four times	5 (8.3)	13 (21.7)
More than four times	10 (16.7)	6 (10)
I had to visit to dentist during the past 12 months	8 (13.3)	5 (8.3)
I have never received dental care/ Visited a dentist	4 (6.7)	9 (15)
I don't know/ I don't remember	6 (10)	7 (11.7)

• Experience of Dental Discomfort

Post-intervention data showed a modest reduction in reported dental discomfort. The percentage of children experiencing toothache often declined from 18.3% to 15.0%, and those reporting it occasionally dropped from 21.7% to 16.7%. Simultaneously, reports of rarely experiencing discomfort increased slightly (23.3% to 25.0%) and never experiencing discomfort rose to 23.3%, suggesting some improvement in perceived oral health. However, the rise in don't know responses (15.0% to 20.0%) indicates lingering uncertainty among participants, potentially reflecting gaps in awareness or difficulty in symptom recognition in Table 12.

Table 12. During the past 12 months, how often have toothache or discomfort?		
Responses	Pre-test N (%)	Post-test N (%)
Often	11 (18.3)	9 (15)
Occasionally	13 (21.7)	10 (16.7)
Rarely	14 (23.3)	15 (25)
Never	13 (21.7)	14 (23.3)
Don't Know	9 (15)	12 (20)

• Substance Use Behavior

Post-intervention dietary patterns exhibited nuanced changes. There was a modest decline in daily consumption of high-sugar items like biscuits and cakes (from 20.0% to 13.3%) and soft drinks (from 13.3% to 8.3% reporting several times a day use), indicating slight dietary moderation. Conversely, intake of sweets/candies increased in the never category (from 16.7% to 28.3%), suggesting improved sugar avoidance for some participants. However, consumption of chewing gum, tea/coffee with sugar, and jam/honey remained relatively stable, with no clear directional trend. Meanwhile, fresh fruit consumption showed only marginal change, implying that healthy alternatives were not significantly emphasized. These results suggest partial behavioral shifts, with improved restriction of certain sugary items, yet highlight the need for sustained emphasis on both sugar reduction and promotion of healthier dietary substitutes (Table 13).

Table 13. What foods and drinks do you usually consume in a day?

Responses	Pre-test N (%)						Post-test N (%)					
	Several times a day	Every day	Several times a week	Once a week	Once a month	Never	Several times a day	Every day	Several times a week	Once a week	Once a month	Never
Fresh fruit	8 (13.3)	13 (21.7)	7 (11.7)	13 (21.7)	6 (10)	13 (21.7)	10 (16.7)	8 (13.3)	9 (15)	12 (13.7)	10 (16.7)	11 (18.3)

Biscuits, cakes, cream cakes, sweet pies, buns etc.	12 (20)	10 (16.7)	12 (13.7)	10 (16.7)	9 (15)	7 (11.7)	18 (30)	10 (16.7)	10 (16.7)	5 (8.3)	8 (13.3)	9 (15)
Lemonade, Coca Cola, or other soft drinks	8 (13.3)	3 (5)	16 (26.7)	9 (15)	10 (16.7)	14 (23.3)	9 (15)	15 (25)	8 (13.3)	12 (13.7)	11 (18.3)	5 (8.3)
Jam/honey	11 (18.3)	11 (18.3)	8 (13.3)	10 (16.7)	9 (15)	11 (18.3)	13 (21.7)	14 (23.3)	7 (11.7)	9 (15)	8 (13.3)	9 (15)
Chewing gum containing sugar	7 (11.7)	10 (16.7)	17 (28.3)	7 (11.7)	11 (18.3)	8 (13.3)	11 (18.3)	11 (18.3)	11 (18.3)	13 (21.7)	4 (6.7)	10 (16.7)
Sweets/candy	9 (15)	11 (18.3)	8 (13.3)	11 (18.3)	11 (18.3)	10 (16.7)	14 (23.3)	3 (5)	8 (13.3)	8 (13.3)	10 (16.7)	17 (28.3)
Milk with sugar	6 (10)	16 (26.7)	8 (13.3)	12 (20)	9 (15)	9 (15)	15 (25)	10 (16.7)	11 (18.3)	6 (10)	8 (13.3)	10 (16.7)
Tea with sugar	10 (16.7)	8 (13.3)	16 (26.7)	6 (10)	13 (21.7)	8 (11.7)	7 (11.7)	11 (18.3)	8 (13.3)	4 (6.7)	13 (21.7)	17 (28.3)
Coffee with sugar	13 (21.7)	9 (15)	11 (18.3)	6 (10)	11 (18.3)	10 (16.7)	8 (13.3)	12 (20)	12 (20)	8 (13.3)	13 (21.7)	7 (11.7)

Post-intervention findings indicate a slight reduction in habitual tobacco use, with regular users dropping from 20.0% to 11.7% and occasional users from 31.7% to 23.3%, suggesting a positive behavioral shift in a portion of the population. However, reports of trying tobacco once or twice marginally increased (13.3% to 15.0%), and the proportion of participants who selected I don't know / I don't want to say rose notably from 16.7% to 26.7%, potentially reflecting increased stigma or reluctance to disclose use. While never users increased to 23.3%, the elevated non-disclosure rate signals a need for more confidential and trust-based approaches in future substance-use assessments (Table 14).

Table 14: Have you used tobacco or products like pan/gutka in the past year?		
Responses	Pre-test N (%)	Post-test N (%)
Yes, regularly	12 (20)	7 (11.7)
Yes, sometimes	19 (31.7)	14 (23.3)
I tried it once or twice	8 (13.3)	9 (15)
No, never	11 (18.3)	14 (23.3)
I don't know / I don't want to say	10 (16.7)	16 (26.7)

3.4 Comparison of Knowledge, Attitude and Practice pre and post scores

The paired samples test results indicate that the differences in pre- and post-intervention scores for knowledge, attitude, and practice were not statistically significant. The knowledge domain showed a p-value of 0.437, indicating no significant improvement following the intervention. Similarly, the attitude scores yielded a p-value of 0.852, and the practice scores had a p-value of 0.462. Since all p-values are greater than the conventional threshold of 0.05, the changes observed in participants' knowledge, attitudes, and practices post-intervention were not statistically meaningful, suggesting the intervention may require reinforcement or a longer follow-up period for significant impact in Table 15.

Table 15: Paired Samples Test

Table 15: Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Knowledge PRE - POST	.05351	.53012	.06844	- .08343	.19045	.782	59	.437
Attitude PRE - POST	- .01667	.69074	.08917	- .19510	.16177	- .187	59	.852
Practice PRE - POST	- .05521	.57709	.07450	- .20429	.09387	- .741	59	.462

DISCUSSION

Oral health education is essential for developing positive behaviors and preventive practices among children, particularly during the formative years when long-term habits and attitudes are shaped¹⁶. In the present study, a puppet show based intervention was employed as an engaging and age-appropriate method to improve oral health knowledge and attitudes among pediatric dental outpatients aged 5–12 years. While the intervention yielded some improvements at the individual item level across knowledge, attitude, and practice (KAP) domains, these changes were not statistically significant in aggregate analysis. Knowledge-related outcomes showed marginal gains post-intervention. A slight increase was noted in participants' understanding of topics such as fluoride use, dietary contributors to dental decay, and awareness of brushing frequency. However, the overall change in knowledge scores did not reach statistical significance (mean difference = 0.05, $p = 0.437$). Similar findings have been reported by Putri et al., (2024), who documented modest gains in oral health knowledge following a similar puppet-based intervention. However, their study emphasized the importance of reinforcement sessions to consolidate learning, which may explain the limited effect observed in the present work¹⁷. For instance, the BMC Oral Health study by Prasai et al., (2023) in Nepal reported that 82% of children did not know about fluoride and 24% brushed twice daily, highlighting similar educational gaps¹⁸.

Knowledge of the harmful effects of tobacco on oral health showed only slight improvement in this study. This finding may be attributed to the abstract nature of the concept for young children and possible limitations in cognitive maturity required to fully understand and retain such information. These results echo the observations of Collins et al., (2020), who noted that tobacco-related health education in children often requires longitudinal reinforcement for significant retention¹⁹.

Attitudinal changes following the intervention were mixed and statistically non-significant (mean difference = -0.017 , $p = 0.852$). Although more children's post-intervention agreed that daily brushing is necessary and recognized the value of dental visits, a large portion remained uncertain or held indifferent views. This delay in attitudinal change relative to knowledge gain has been similarly observed by Evans et al., (2019), who emphasized that attitudes, particularly in younger populations, tend to evolve gradually and require experiential reinforcement²⁰. A positive indication in the present study was the slight improvement in children's perception of their dental appearance and a reduction in reported embarrassment while smiling, suggesting emerging self-awareness and comfort. Tsolakidis, (2024) reported comparable findings, where puppet-based interventions effectively reduced dental anxiety and improved self-perception in children²¹. Oral hygiene practices exhibited some improvement, particularly in the reduction of participants who reported never brushing their teeth (from 25.0% to 11.7%). However, the results were inconsistent across other variables. Use of standard cleaning tools such

as toothbrushes showed improvement, while use of toothpaste surprisingly declined in some cases. Similar mixed trends were reported by Baker et al., (2019), who emphasized that behavior change among children often requires parental involvement and reinforcement at home to ensure consistency and habit formation ²². In terms of dietary behavior, slight reductions were seen in the frequency of sugary food and beverage consumption, but intake of items such as tea, coffee, and chewing gum containing sugar remained high. A decline in regular tobacco product use was also observed, yet this was accompanied by a rise in non-disclosure responses, indicating either increase stigma or hesitancy to report use. Fung et al., (2024) identified a similar pattern in school-based studies and suggested that social desirability bias and lack of comprehension could obscure true behavioral patterns in younger cohorts ²³.

Despite these directional trends, the paired samples test did not demonstrate statistically significant differences in pre- and post-intervention scores across knowledge, attitude, or practice domains. These findings are consistent with those of Schleider and Beidas, (2022), who concluded that single-session educational tools, though beneficial for initial engagement, are often insufficient for inducing sustained behavioral change [24]. The present study thus supports the position that puppet shows can serve as effective introductory tools for oral health promotion in pediatric settings, but should be incorporated into broader, multi-modal and repetitive educational strategies to achieve long-term impact.

Despite its promising approach, the study had notable limitations. The single-session design without follow-up may have limited long-term knowledge retention and behavior change. Self-reported responses introduced potential bias, and the outpatient sample may not reflect broader pediatric populations. Future research with longitudinal, multi-session formats is recommended.

CONCLUSION

This study concludes that puppet show-based oral health education serves as a creative and engaging tool for delivering preventive dental knowledge among pediatric dental outpatients. While the intervention demonstrated modest improvements in item-level knowledge and shifts in attitude and practice domains, the overall statistical changes in KAP scores were not significant. Nevertheless, the findings underscore the potential of interactive, child-friendly educational methods in raising awareness about oral hygiene. The effectiveness of such interventions may be enhanced with repeated sessions, parental involvement, and reinforcement strategies. The study also highlights the importance of tailoring health education tools to suit cognitive and emotional development in children. Despite its limitations, this research contributes to the evolving framework of community-based pediatric oral health promotion.

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DECLARATIONS

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Institutional Ethics Committee.

Consent for Publication

The patient provided written informed consent for the publication of this case report, including clinical images and radiographic findings.

Competing Interests

The authors declare that they have no competing interests related to this study.

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REFERENCES

- [1]. Giacaman RA, Fernández CE, Muñoz-Sandoval C, León S, García-Manríquez N, Echeverría C, Valdés S, Castro RJ, Gambetta-Tessini K. Understanding dental caries as a non-communicable and behavioral disease: Management implications. *Frontiers in oral health*. 2022 Aug 24;3:764479.
- [2]. Njoroge N, Magan A, Hlongwa P. Oral health in children and adolescents with special healthcare needs in South Africa: A narrative review. *South African Dental Journal*. 2024 Mar 1;79(2):102-8.
- [3]. Butera A, Maiorani C, Morandini A, Simonini M, Morittu S, Trombini J, Scribante A. Evaluation of children caries risk factors: A narrative review of nutritional aspects, oral hygiene habits, and bacterial alterations. *Children*. 2022 15;9(2):262.
- [4]. Adege EP. Integrating pediatric oral health into primary care: A public health strategy to combat oral diseases in children across the United States. *International Journal of Multidisciplinary Research Updates*. 2024;7(1):27-36.
- [5]. Wolff M, Wagner MJ, Poznanski S, Schiller J, Santen S. Not another boring lecture: engaging learners with active learning techniques. *The Journal of emerg. medicine*. 2015;48(1):85-93.
- [6]. Kelder SH, Hoelscher D, Perry CL. How individuals, environments, and health behaviors interact. *Health behavior: Theory, research, and practice*. 2015 Jul 1;159:144-9.
- [7]. John A. The Role of Play-Based Learning in Fostering Social-Emotional Skills and Resilience in Young Children Affected by Trauma. Available at SSRN 5280263. 2025 Jun 3.
- [8]. Parsloe SM, Leon JD, Allen L, Junczewski S. The Power of Puppetry as an Arts-Based Tool for Health and Disability Communication Research. *Health Communication*. 2024 Oct 27:1-2.
- [9]. Abdelrahman MM, Hashem R, Abo-Seif LM, Elsehrawy MG. The role of nursing in promoting nutritional awareness: insights from interactive educational approaches. *BMC nursing*. 2025 Jul 1;24(1):748.
- [10]. Ladera-Castañeda M, Córdova-Limaylla NE, Briceño-Vergel G, Rosas-Díaz JC, Cervantes-Ganoza LA, Cayo-Rojas CF. Impact of puppet theater on oral health knowledge and oral hygiene in preschoolers from a peruvian educational institution: A quasi-experimental study. *Journal of International Society of Preventive and Community Dentistry*. 2022 Jan 1;12(1):28-37.
- [11]. Asrori M, Asy'arie BF, Akhirudin, Yusup Sofian G, Syakir Hidayat AF, Suja A, Roibin. Islamic educational and cultural values in Indonesian puppetry art: a systematic literature review. *Cogent Education*. 2025 Dec 31;12(1):2490445.
- [12]. Tewari N, Mathur VP, Kaur A, Sardana D, Rahul M, Tamchos R, Ritwik P, Goel S, Schiavo J. Evidence mapping and quality assessment of systematic reviews in dentaltraumatology. *DentalTraum*.2021;37(1):17-36.
- [13]. Riad A, Al-Khanati NM, Issa J, Zenati M, Abdesslem NB, Attia S, Krsek M. Oral health-related knowledge, attitudes and behaviours of arab dental students: multinational cross-sectional study and literature analysis 2000–2020. *International journal of environmental research and public health*. 2022 Jan 31;19(3):1658.
- [14]. Abdulrahim M, AlKandari M, Alomari Q, Baskaradoss JK. Oral health knowledge, attitude and practice among adolescents in Kuwait. *International Journal of Adolescent Medicine and Health*. 2022 Dec 1;34(6):437-42.
- [15]. Alhabahbeh R, Alryalat SA, Al-Jaghbir MT. Oral Health Knowledge Attitudes and Practices of Parents of Preschool Children in Amman, Jordan 2019: A Descriptive Cross-Sectional Study: Children's Oral health knowledge in parents. *Jord.Med.J*.2024.24;58(2).
- [16]. Sava-Rosianu R, Dumitrescu R, Galuscan A. Modern Approaches to Children's Oral Health: Contemporary Risk Factors and the Influence of Parental Education.
- [17]. Putri MY, Larasati R, Prasetyowati S, Ansari A. The effectiveness of puppets as an educational tool to enhance dental health knowledge among elementary school students in Surabaya, Indonesia. *International Journal of Advanced Health Science and Technology*. 2024 Oct 25;4(5):305-11.
- [18]. Prasai Dixit L, Shakya A, Shrestha M, Shrestha A. Dental caries prevalence, oral health knowledge and practice among indigenous Chepang school children of Nepal. *BMC oral Health*. 2023 May 14;13(1):20.
- [19]. Collins BN, Nair US, DiSantis KI, Hovell MF, Davis SM, Rodriguez D, Audrain-McGovern J. Long-Term results from the fresh RCT: sustained reduction of children's tobacco smoke exposure. *American journal of preventive medicine*. 2020 Jan 1;58(1):21-30.
- [20]. Evans K, Furlong A. Metaphors of youth transitions: niches, pathways, trajectories or navigations. In *Youth, citizenship and social change in a European context* 2019 ,17-41
- [21]. Tsolakidis S. Speaking to one's younger self-A Virtual Reality Assisted Intervention for Self-Compassion: A Quantitative Study (Doctoral dissertation), UCL 2024.
- [22]. Baker S, Morawska A, Mitchell A. Promoting children's healthy habits through self-regulation via parenting. *Clinical child and family psychology review*. 2019 Mar 15;22(1):52-62.
- [23]. Fung AL, Wong MK. An innovative storytelling intervention to reduce school aggression among schoolchildren with reactive and proactive aggression. *American Journal of Orthopsychiatry*. 2024 Dec 2.
- [24]. Schleider JL, Beidas RS. Harnessing the single-session intervention approach to promote scalable implementation of evidence-based practices in healthcare. *Frontiers in Health Services*. 2022 Sep 23;2:997406.