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Effectiveness of School Nurses promoting Oral Health among 7-15 Years old School Children in Nepal

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Abstract

Background

Gingival diseases and dental caries are significant global burdens, especially in low- and middle income countries. The Nepal government has initiated the One School, One Nurse program in the county since 2019. The study aimed to assess the efficacy of school nurses leading in promoting oral health among schoolchildren in Nepal.

Methods

A prospective cohort study was conducted among 324 students (aged 7–15) from three different government schools with school nurses in the Kavre district of Nepal. An intervention group received weekly reinforced oral health education from a trained school nurse. A semi-intervention group received a single education session, while a control group didn't receive any training or intervention. Expert dentists collected baseline and three months of follow-up data on dental caries, plaque index, and gingival index.

Results

Baseline data recorded high dental caries prevalence in both primary (48.9%) and permanent dentition (46.8%). Students (52.9%) brush their teeth occasionally, and 46.2% of them use non-fluoridated toothpaste. There was a significant reduction in the plaque score (2.06 ± 0.63 to 1.50 ± 0.54) in the intervention group compared to the semi-intervention and control groups (2.06 to 2.02 and 2.18 to 2.06). There was improved gingival bleeding in the intervention group (3.4 ± ± 2.47 to 1.32 ± 1.20), whereas minimal improvement was observed in the semi-intervention group, and oral health status remained unchanged or worsened in the control group.

Conclusion

School nurses play a significant role in improving the gingival health of school children and are effective in promoting oral health among the school children, especially in the low- and middle-income countries where there is no provision of school dental nurses.

Introduction

Untreated dental caries is the most prevalent global health condition [1], often excluded from universal health coverage, with oral diseases affecting 70–95% of school-aged children in Southeast Asia. This burden is particularly significant in low- and middle-income countries due to insufficient preventive and treatment services and health inequalities [2].

In Nepal, the "National School Health and Nutrition Strategy" and "One School One Nurse" program [3] aim to strengthen health promotion, including through "health ambassadors" [4]. However, the National Health Insurance program offers limited or no oral health coverage [5], leading to high out-of-pocket expenditures, especially for lower-income households [6].

School nurses, despite their potential, are an underutilized resource in oral health promotion. Previous research highlights their crucial role and the effectiveness of reinforced oral health education [7, 8, 9]. This study will evaluate the effectiveness of school nurses in promoting oral health among 7 to 15-year-old schoolchildren in Nepal's Kavre Palanchowk district.

Methodology

The Quasi Experiment was conducted among 324 students (aged 7–15) from the three government schools in Kavre palanchowk district (1. Shree Bhaleshwor secondary school, Panauti Municipality. 2. Shree Roshi Secondary School, Roshi Rural Municipality 3. Shree Setidevi Secondary School, Ravi Opi. Dhulikhel Municipality). Baseline data were collected and follow up data were recorded after three months.

Sample Size: A convenience sampling technique were used, with total sample size needed for this study was 297. This study considered 80% power and 95% CI where mean score of the experimental group was taken 0.78 ± 0.42 and mean score control group was taken: 0.94 ± 0.3822 from Shenoy et al [10]. Using the formula of sample size (n) = $2 (Z_{\alpha/2} + Z_{\beta})^2 \sigma^2)/ (\mu_1 - \mu_2)^2$ Total sample size calculated 99 in each group.

Methods: This study was conducted from February to May 2025 where screening was done in the school premises by Nepal Medical Council registered dentist with sterilized dental kit and head lamp in the well illuminated area under universal precautions. Both verbal and written consent (Assent form) was taken from students, respective class teachers and parents. Two trained and calibrated dentists from Kathmandu University School of medical Sciences, collected the data from the participants including demographic details with Socio economic status, Kuppuswamy's SES scale [11]. WHO Basic Oral health Surveys methods- Dentition status [12] was used to record Dentition status whereas Turesky–Gilmore–Glickman modification of the Quigley-Hein plaque index and Loe and Sillness Gingival index was used to record plaque and gingival status.

Demographic details were recorded, height and weight were scaled to record body Mass index followed by three set of self-reported questions regarding tooth brushing frequency, type of toothpaste using and availability of the toothbrush. They were asked with the help of the pictures, whether they were using fluoridated or non-fluoridated toothpaste showing commonly used and available tooth paste in the Nepal. Regarding the Modified Kuppuswamy scale, Socio economic status of the parents, we provided each students with the chart to record the Education Level, occupation of the head of the household and average total monthly family income, data were recorded by the individual parents and submitted to the

school teacher on the next day. Molar Incisor hypoplasia was recorded according to the European Academy of Pediatric Dentistry Criteria (EAPD) [13]. Two Tone™ Disclosing Solution were used to reveal both older and newer plaque with the help of tweezer and cotton pellet. Gingival bleeding was recorded by drying the gingiva and periodontal probe and the recording was made based on gingival bleeding.

Three schools were selected according to the geographical, cultural and similar life style in the same district after the approval of the Education development and co-ordination unit, Kavrepalanchowk. The schools were divided into three groups. Group 1 (Intervention group, IG): Oral health education training (OHET) was given to school nurse at the respective school by the expert Public health Dentist (PI) followed by two days special oral health training in the department of Community and public health dentistry, Dhulikhel Hospital. OHET includes Introduction to Oral health, Prevention of Oral Disease, Common oral disease and condition of children, Role of plaque and calculus on gingival disease and dental caries, Role of fluoride, Tooth brushing technique and supervision. Weekly oral health education (One hour) was given to the students by the school nurse under supervision of the Investigators. Group 2 (Semi-intervention group, SIG): No oral health related training (OHET) was given to the school nurse at the respective school but one time oral health education was given to the students in the school premises by expert dentist regarding oral health promotion, importance of brushing and brushing technique only after baseline data collection. This in commonly practiced methods of oral health program in Nepal. Group 3 (Control group, CG): In this school, there was no oral health education training (OHET) given to the school nurse and students whereas, no supervision was done by the dentist regarding the program.

Eligibility criteria: Students aged 7–15 years old from government schools from Kavre Palanchowk District where there must be recruitment of school nurses in School were included in this study. The participants must provide verbal consent and assent form for oral examination whereas children with systemic disease and or requiring emergency dental treatment, ongoing orthodontic treatment and those refuse to participate in this study will not be included in this study.

Data Analysis: Data were entered into a Microsoft Excel spreadsheet and subsequently imported into SPSS Statistics (Version 25.0) for analysis. A p-value of < 0.05 was considered statistically significant for all inferential tests. Descriptive statistics were used to summarize the socio-demographic characteristics of the participants. Non-parametric tests were employed for all comparative analyses. The Kruskal-Wallis test was utilized to compare mean scores among the three independent study groups for paired comparisons of pre- and post-intervention data, within each group, the Wilcoxon signed-rank test was used.

Result

This study was conducted among 324 government students age ranging from 7 to 15 years old, with 178 (54%) boys and 146 (46%) girls. Socio economic Status of the students were collected from the parents, where most of the students are from upper lower group 178(54.9%), followed by lower middle class 107

(33%), lower group 34 (10.5%) and only 5 (1.5%) belonged to upper middle group. surprisingly, 226 (69.5%) of the students were underweight, whereas 81(24.9%) of them had normal body mass index and only 2 of them are obese. (Table 1).

Table 1
Demographic Distribution of the students.

(N, %)	**N = 324**
Age	**178 (54)**
7–11 years old	
12–15 years old	146 (46)
Gender	
Boy	168 (51.9)
Girl	156 (48.1)
Socio Economic Status	
Upper Middle	5 (1.5)
Lower Middle	107 (33)
Upper Lower	178 (54.9)
Lower	34 (10.5)
Body Mass Index	
1 Underweight	226 (69.5)
2 Normal BMI	81 (24.9)
3 Over weight	15 (4.6)
4 Obese	2 (0.6)
School	
1. Shree Bhaleshwor Secondary School, Panauti	127 (39.1)
2. Shree Roshi Secondary School, Katunjebeshi	82 (25.3)
3. Shree Seti Devi Secondary School, Bhumlu	115 (35.5)

During the baseline data collection, 158 (48.9%) of the students had decayed primary tooth, dmft whereas 151(46.8%) of them had decayed permanent tooth, DMFT. The mean dmft and DMFT score of the students was 1.72 ± 2.29 (0–10) and 1.19 ± 1.67 (0–12). The overall plaque index score was 2.1 ± 0.64 and the mean gingival bleeding score was 3.99 ± 2.85. Self -reported oral hygiene questionnaire were asked to the students where 314 (96.6%) students had tooth brush, Nearly half of the children 150

(46.2%) use non-fluoridated toothpaste and more than half 172 (52.9%) of the students brush occasionally and six of them never brushes their teeth. (Table 2)

Table 2
Baseline result of the students N = 324 (Mean and proportion)

dmft	**Mean ± SD**	**Range**	**N (%)**		
	1.72 ± 2.29	**0–10**	**158 (48.9)**		
DMFT	1.19 ± 1.67	0–12	151 (46.8)		
PI	2.1 ± 0.64	0–4.3			
GB	3.99 ± 2.85	0–17	303 (93.5)		
Q1	Do you have tooth brush	Yes 314 (96.6)	No 10 (3.1)		
Q2	Which tooth paste do you use	Fluoridated 171 (52.6)	Non fluoridated 150 (46.2)		
Q3	How many times do you brush your teeth?	Occasionally 172 (52.9)	Once a day 114 (35.1)	Twice a day 31 (9.5)	Never 6 (1.8)
dmft: primary decayed missing filled tooth					
DMFT: permanent Decayed Missing Filled Tooth					
PI: Plaque Index					
GB: Gingival bleeding					

Molar Incisor hypo mineralisation (MIH) was present on 26.9% among 324 children, Type 1 MIH was most prevalent among other type classified by European Academy of paediatric dentistry where 18.8% have demarcated opacities with localized discoloration in enamel whereas only 1.9% of them have severe form of MIH (Table 3).

Table 3
Distribution of Molar Incisor hypoplasia among the students.

Present N (%)	**Absent N (%)**		**Type of MIH present N (%)**	
87 (26.9)	237 (73.1)		Absent	273 (73.1)
			Type 1	61 (18.8)
			Type 2	20 (6.2)
MIH Distribution according to the school			Type 3	6 (1.9)
	Present	Absent		
School 1 N (%) 127	44 (34.6)	83 (65.4)		
School 2 N (%) 82	22 (26.8)	60 (73.2)		
School 3 N (%) 115	21 9 (18.3)	94 (81.7)		

The mean plaque index score for group 1 decreased from 2.06 ± 0.63 to 1.50 ± 0.54 whereas group 2 and group 3 showed very minimal decrease from 2.06 ± 0.68 to 2.02 ± 0.69 and 2.18 ± 0.64 to 2.06 ± 0.98. Overall, plaque levels were slightly improved across all groups with group 1 showing significant reduction in plaque scores ($p < 0.05$). (Table 4) The mean gingival bleeding score for group 1 showed significant decrease from 3.4 ± 2.47 to 1.32 ± 1.20 suggesting clear improvement in gingival health whereas group 2 showed slight decrease from 4.94 ± 2.75 to 4.59 ± 2.662 suggesting slight improvement and group 3 showed increase from 3.97 ± 3.14 to 4.96 ± 3.18 suggesting deterioration of gingival health. (Table 5)

During data analysis, dependent variables were tested for normality which showed skewed distribution. Hence non parametric tests were employed for comparison of paired data. Wilcoxon sign rank test was used for paired comparisons. (Table 5) In Group 1, significant reduction in median plaque from 1.95 (2.43–1.6) to 1.37(1.79–1.17) were observed ($p < 0.001$). Median Gingival bleeding scores also showed significant reductions. In the semi intervention group median plaque scores showed slight reduction from 1.96 (2.56–1.56) to 1.89 (2.53–1.47), however the results were not statistically significant. Gingival bleeding remained constant at a median score of 4 pre and post intervention. For group 3, Plaque scores reduced slightly from 2.15 (2.62–1.75) to 2.03 (2.45–1.45). Gingival bleeding increased significantly from a median score of 3 (5 − 2) to 5 (7 − 2). ($P < 0.05$) However new carious lesion seems increased in all the groups with loss of follow up 17 (14.8%) in control group (not shown in the table)

Table 4
Comparisons of gingival and plaque scores among intervention, semi intervention and control schools

	Intervention group mean ± S.D		Semi Intervention group mean ± S.D		Control group Mean ± S.D	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
DMFT	0.94 ± 1.29	0.98 ± 1.28	0.89 ± 1.33	1.15 ± 1.47	1.67 ± 2.11	1.86 ± 2.06
Plaque Index	2.06 ± 0.63	1.50 ± 0.54	2.06 ± 0.68	2.02 ± 0.69	2.18 ± 0.64	2.06 ± 0.98
GB	3.4 ± 2.47	1.32 ± 1.20	4.94 ± 2.75	4.59 ± 2.66	3.97 ± 3.14	4.96 ± 3.18
DMFT: Permanent Decayed Missing Filled Tooth						
GB: Gingival Bleeding						

Table 5
Comparison of median plaque and gingival scores among case and control group (pre and post intervention)

		Pre, Median (IQR)	Post, Median (IQR)	p value
Intervention Group 1	Plaque scores	1.95 (2.43–1.6)	1.37 (1.79–1.17)	< 0.001
	Gingival Bleeding	3 (5 – 1)	1 (2 – 0)	< 0.001
Semi intervention group 2	Plaque scores	1.96 (2.56–1.56)	1.89 (2.53–1.47)	0.35
	Gingival Bleeding	4 (7 – 3)	4 (6 – 2)	0.06
Control Group 3	Plaque scores	2.15 (2.62–1.75)	2.03 (2.45–1.45)	< 0.01
	Gingival Bleeding	3 (5 – 2)	5 (7 – 2)	< 0.01

Discussion

Our study shows that oral health education to the school nurse in the schools are effective strategy for improving oral health outcomes among students. we observed significant reduction in plaque and gingival bleeding among the intervention group compared to control, that align with the previous studies by Subedi et al [9] and Ganesh et al [14], which reported that school based OHE programs improves the students oral health knowledge and practices, leading to better plaque control and gingival health with daily tooth brushing activity. This study prioritize the reinforced weekly OHE delivered by the school nurse to the students over three months, this approach is supported by Shenoy et al [10], who mentioned that more frequent OHE (three weeks interval) was more effective than less frequent time period of (six weeks interval). Our study showed that there is marked reduction in mean plaque index among intervention group (2.06 to 1.5) and bleeding gum (3.4 to 1.32) while control group showed minimal

improvement or a worsening of the conditions. These results are consistent with similar interventions studies by Shahapur et al [15] and Reddy et al [16].

The need of the study highlights the high burden of oral disease among the students, our baseline data shows the high prevalence of dental caries 48.9% in primary teeth and 46.8% in the permanent dentition, which is higher than the study done by lee et al [17] and the global average of 43% in primary dentition and 28.7% in primary dentition according to the global health observatory, global status report on oral health 2023, World health Organization [18]. Which might be linked with the high percentage of children (46.2%) using non fluoridated toothpaste. This study provides a comprehensive distribution of the prevalence of MIH, 26.9% compared to the global prevalence rate [19]. The global average for MIH is 14.2%, however prevalence ranges widely from 2.4 to 40.2%. This indicates that MIH varies significantly among communities [20]

School nurses represent a critical frontline resources in addressing this public health issue through integrated oral health promotion. The socio economic barrier and literacy rate among the older generation, and rural urban disparities limits access to dental services, where most of the children never visit the dentist which increase the chances of disease progression. The impact of OHE program depends upon the time interval of the education provided to the students. The study done in Nepal to evaluate the oral health related knowledge, attitude and practices among the student nurses shows adequate oral health Knowledge attitude and practice [21]. Hence we can reinforce this practices through oral health training to the school nurses by Dentist or dental professionals. There are very few study done to improve oral health through School nurses, Baginska et al [22] conducted the study that highlights the role of polish school nurses to promote the oral health among school children 7–19 years old, and concluded that school nurses have potentially crucial role in improving the oral health status of the children and pupils through oral health education, dietary counselling and fluoride prophylaxis, which supports our study, undoubtedly Dentist should support school nurses with provision of OHE training through local and national level.

This nurse-led OHE program proved effective, the literature suggests its impact could be further enhanced by integrating our approach with supervised tooth-brushing programs, as supported by Damle et al [23]. A systematic review by Bramantoro et al. [24] confirms that school-based programs are most effective when they are comprehensive and repetitive. Future programs could also incorporate more engaging educational methods, such as games and drama [25], or adopt a holistic model that involves parents and teachers to achieve more sustainable outcomes [26, 27].

The influence of school nurses often extends beyond the school environment, as educated children share knowledge with their family members, creating a ripple effect in oral health promotion. School nurses' acts as liaisons between families and dental health services which improve access to care, ensuring the necessary

dental treatment and referral. Different studies done among school nurses regarding oral health shows significant improve in oral health of the school children through different oral health program and

activities.

Challenges and problems: Many school nurses lacks specialized oral health training, insufficient funding and materials limit the scope of oral health program that can be done in school. Inconsistent support from education and health policies often results in a lack of clear mandates for school nurses to prioritize oral health promotion. Furthermore, a key administrative challenge is the retention of school nurses, which undermines the continuity of any oral health program.

Recommendation, way forward:

- Policy development: Advocate for the creation and enforcement of education and health policies that explicitly prioritize school-based oral health programs and designate clear responsibilities for school nurses.
- Develop and implement a standardized, nationwide oral health training curriculum to provide school nurses with the essential knowledge and practical skills for effective student care and education.
- Foster strategic partnerships between schools, dental professionals, and local health authorities to strengthen program initiatives, secure resources, and enhance community-wide awareness and support.

Limitation:

The scope of the study was confined to single district in Nepal, which may limit the generalizability of the findings to other regions of the country. This study design employed non-random allocation of schools, introducing possible selection bias and confounding variables. Furthermore, duration of the study was of only three months, relatively short, which might be insufficient to capture long term sustainability of the behavior changes. The study focus was on students and and school nurses only, excluding other stakeholders like teachers and administrative staffs. Future research should aim to address through multisite, randomized trials with longer follow up periods.

Benefit of this study:

This program could be great milestone to prevent possible dental caries and gingival disease among students. This program will help them to adopt healthy life style with improve in oral health practice. Middle income Country like Nepal can adopt this type of program to empower existing school nurse to improve oral health related quality of life among the school children and further such program can be included in National Oral Health Policy of Nepal.

Conclusion

This study showed that empowering school nurses with oral health training is a highly effective strategy to improve oral hygiene and gingival health in school children, particularly in low and middle income countries with high disease prevalence where there is no provision of school dental nurses. The

significant reduction in plaque and gingival bleeding in intervention group confirms that reinforced education delivered by the nurses is the effective way to control oral diseases rather than providing traditional one time oral health education to the school children.

School Nurses have potential to influence children's oral health through education, early detection and community engagement. By prioritizing oral health promotion in the school health framework, Nepal can improve children's overall health outcomes and reduce the burden of oral health. However, overcoming barriers related to training, resources and policy support is essential to maximize their effectiveness. This information can help in future oral health promotion initiatives and preventive measures across the Nepal. This research will inform the policy makers and healthcare providers on the necessity of school-based preventive oral health programs.

Declarations

Ethical Considerations and consent to Participants

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval for the study was obtained from the Institutional Review Committee, Kathmandu University School of Medical Sciences (IRC, KUSMS) with approval number 354/24 on dated January 2025. Written informed consent was obtained from the parents or legal guardians of all participating children (aged 7–15 years) prior to the commencement of the study. Additionally, verbal/written assent was obtained from the children themselves after explaining the study in a local Nepali language they could easily understand. Before the study, we had meeting with School nurses, teachers and stakeholders where we discussed about the programs in details and the letter of permission were taken from the respective three school before the study

Consent for Publication

Written informed consent was obtained from the participants, School Principals and School Nurses for the publication of this study.

Competing Interest:

None

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This study did not receive any specific grant from funding agencies.

Author Contribution

DP and SP Conceptualized and designed the study, developed the school nurse intervention protocol, and drafted the original manuscript. DP, DRP and RY Coordinated field activities in Nepal, supervised the school nurses, and was responsible for data collection and investigation among the 7–15-year-old participants.DP, RKC and SKM provided methodological guidance, reviewed and edited the manuscript for critical intellectual content, and provided administrative and technical support. DP and SP Acted as the project supervisor, secured necessary institutional resources, and provided final approval of the version to be published.All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.(DP: Dilip Prajapati, SP: Shaili Pradhan. DRP: Darpa Pradhan, RY: Ramesh Yadav, SKM: Swagat Kumar Yadav, RKC:Roshan Kumar Chaudhary)

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Data Availability

Data analysed or generated in this study can be obtained on reasonable request by contacting the corresponding author.

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