



Research Article

Association of communication barriers with oral health status and oral health-related quality of life among children with hearing and speech impairment in Bengaluru city - A comparative study

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ABSTRACT

Objectives: Children with hearing and speech impairment (HSI) are vulnerable to marginalization in healthcare, including dentistry, where effective communication is vital. This study aimed to assess the association of communication barriers with oral health status and oral health-related quality of life (OHRQoL) in children with HSI. **Materials and Methods:** A cross-sectional study was conducted among 300 HSI and non-HSI participants selected from different special schools and regular schools, respectively, in Bengaluru. Communication barriers and OHRQoL were assessed using a pre-validated Communication Barriers Questionnaire (CBQ) and Child Oral Health Impact Profile - Short Form 19 (COHIP-SF 19) questionnaire, respectively. Oral health was assessed using the World Health Organization Oral Health Assessment Form for Children, 2013. Chi-square test, Pearson's correlation coefficient, independent sample t-test, and multivariate linear regression analyses were performed, and $P < 0.05$ was considered statistically significant. **Results:** The mean age of HSI and non-HSI participants was 12.7 ± 1.52 and 12.21 ± 1.32 years, respectively. The mean CBQ scores were 30.94 and 18.56 among HSI and non-HSI groups, respectively. The mean COHIP-SF 19 scores were 51.98 and 57.52 among HSI and non-HSI groups, respectively. There was a statistically significant association between communication barriers, oral health status, and OHRQoL among participants with HSI ($P < 0.001$). Multivariate linear regression analyses revealed a statistically significant association of age, gender, degree of hearing impairment, communication barriers, and gingival bleeding with OHRQoL as the dependent variable ($P < 0.001$). **Conclusion:** There was a statistically significant association of communication barriers with oral health status and OHRQoL among participants with HSI. These outcomes underscore the urgent need for inclusive communication strategies in dental settings and the integration of specialized training for oral health professionals to effectively interact with subjects with HSI.

Keywords: Communication barrier, Hearing impairment, Oral health related quality of life (OHRQoL), Oral health, Speech impairment

INTRODUCTION

Throughout human history, communication has played a central role in shaping our social world. As societies advanced, language became more complex, allowing for the transmission of ideas across generations and the construction of collective identities.^[1] Across time, hearing has remained integral to the passage of rich interpersonal information and may be thought of as the principal afferent system of social life.^[2] Hearing and speech play multiple essential roles such as facilitating communication, building relationships, expressing emotions, and understanding

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social cues by shaping our social interactions.^[2] However, hearing loss and deafness are widespread and found in every region and country. As of 2025, more than 1.5 billion people (nearly 20% of the global population) live with hearing loss. It is expected that by 2050, 2.5 billion people are projected to have some degree of hearing loss, and more than 700 million will require hearing rehabilitation.^[3] Looking at the statistics from India alone, according to the 2011 census, more than 3 million people have disabling hearing loss, and more than 1.2 million people have a speech disability.^[4] Hearing impairment is a general term that refers to any level of hearing loss, ranging from mild (15–30 dB) to profound loss (exceeding 95 dB). Speech impairment, also known as a speech disorder, affects a person's ability to produce speech sounds or comprehend and use language, which can interfere with communication and academic performance.^[5]

Oral health being a part of general health affects the overall wellbeing of any individual.^[6] Oral healthcare access has continued to be a challenge for individuals with special needs in the 21st century.^[7] Furthermore, children with special needs have poor oral hygiene owing to disability of sensory, motor, intellectual function, and communication barriers.^[8] Children with hearing and speech impairment (HSI) have been reported to have neglected oral health than their normal counterparts, with a high prevalence of dental caries (40–55%), gingival diseases (49.6%), and dental traumatic injuries (14%).^[9] Individuals with disabilities may have compromised oral health needs due to neglect from parents, socioeconomic problems, and communication barriers.^[10] The severity and magnitude of dental problems in the hearing-impaired population are high and have more untreated dental conditions than the general population.^[11] Despite their vulnerability, little evidence exists on how communication barriers affect oral health and related quality of life (OHRQoL) in children with HSI. This study aimed to assess the association between communication barriers, oral health status, and OHRQoL among such children in Bengaluru and to provide insights into oral health disparities and the need for inclusive, targeted interventions.

MATERIALS AND METHODS

This analytical cross-sectional study is reported according to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for observational studies,^[12] and the study protocol was approved by the Institutional Ethics Committee (reference number GDCRI/IEC-ACM(2)/01/2023-24). Necessary permissions were obtained from the Heads of special schools and the Deputy Director of Public Instructions. The investigator was trained and calibrated before commencement of the study. The Kappa coefficient (*k*) for intra-examiner reliability for the study tools was 0.90, reflecting a high degree of conformity

in observation. The study participants included 10–15-year-old hearing and speech-impaired children, along with age and gender-matched school children as a comparison group. Participants were recruited from special schools for the HSI group and government, aided, and private schools in Bengaluru city for the comparison group. The study protocol was explained to school authorities and permission was obtained. Written informed consent and assent were obtained from the parents and children.

According to previous literature, the prevalence of dental caries in hearing and speech-impaired children ranged from 57.7% to 65%.^[5,8] Sample size was calculated using the formula ($N = Z\alpha/2^2 * p(1-p)/E^2$) where P = Prevalence or proportion (57%); $Z\alpha/2 = 1.96$ at 95% confidence interval; E = Margin of error-10%; Statistical power = 80%. By substituting the values, the sample size was estimated to be 294, which was rounded off to 300 participants. Hence, three hundred 10 to 15-year-old children were selected from various schools and institutes for the hearing and speech impaired in Bengaluru city, along with three hundred matched comparative subjects selected from government, aided, and private schools. Stratified cluster sampling was employed to include hearing and speech-impaired children across various special schools in Bengaluru city. The list of special schools for the hearing and speech impaired was first obtained. These schools were then plotted on a map of Bengaluru which was divided into 2 zones: North and South. A total of six special schools were randomly selected from 2 zones. Three hundred children were then randomly selected from each of the schools so that there is an equal representation of the participants with respect to age and gender. Participants for the comparison group (non-HSI group) were selected from regular schools in a similar geographic location.

A pre-validated communication barriers questionnaire (CBQ)^[13] and Child Oral Health Impact Profile - Short Form 19 (COHIP-SF 19)^[14] were used to collect information pertaining to communication barriers and OHRQoL [Figure 1, Supplementary File 1]. CBQ consists of eleven questions, the responses of which were assessed using a five-point Likert scale and higher scores indicating communication barriers among children. COHIP-SF 19 consists of 19 items with three domains: Oral health, functional well-being, and socio-emotional well-being. The response to each question is recorded on 5-point Likert scale. Higher scores indicate good OHRQoL. Internal consistency (α) of CBQ (Cronbach's alpha 0.8) and COHIP-SF 19 (Cronbach's alpha 0.9) was found to be good. Cross-cultural validation^[15] of both questionnaires was performed by means of forward and back translation (English to Kannada and Kannada to English). Oral health status among the participants was assessed using the World Health Organization (WHO) Oral Health Assessment Form for Children, Pro forma 2013.^[16]

Data were collected during the school working hours. In special schools, questionnaires were administered to the study participants through the class teachers. Demographic details and past medical history were collected from the schools. The purpose of the study was informed to the participants through their teachers, and instructions were given to fill out the questionnaire. In regular schools, students were administered questionnaires and asked to fill it after explaining the purpose of the study. Students took about 30–35 min to answer the questionnaire and it was collected back and scrutinized for completeness. The children were seated on a comfortable chair and examined under natural light. Strict infection control and sterilization were maintained throughout the study. Clinical assessment was performed using the WHO oral health assessment form for children, 2013 and recorded by a single calibrated investigator. Statistical analysis was performed using the Statistical Package for the Social Sciences version 26 (IBM, Chicago, IL, USA). Data normality was assessed with the Kolmogorov–Smirnov test. Descriptive statistics (mean, SD, and proportions) were computed. Chi-square and independent *t*-tests were used for group comparisons. Pearson's correlation assessed relationships between communication barriers, oral health status, and OHRQoL. Hierarchical multivariate linear regression was applied to evaluate adjusted associations. A $P < 0.05$ was considered statistically significant.

RESULTS

A total of 300 HSI and 300 non-HSI children participated in the study. The mean age was 12.7 ± 1.52 years in the HSI group and 12.21 ± 1.32 years in the non-HSI group. Both groups showed nearly equal gender distribution (HSI: 52% males, 48% females; non-HSI: 53.7% males, 46.3% females). Most parents in both groups belonged to the lower-middle socioeconomic class or below [Table 1]. HSI participants experienced significantly greater communication barriers and poor OHRQoL compared to non-HSI participants. There was a significant difference between HSI and non-HSI groups with respect to caries experience, gingival bleeding, and dental trauma [Table 2]. Communication barriers showed a moderate negative correlation with OHRQoL and a weak-positive correlation with dental caries experience and gingival bleeding. Oral health-related quality of life (OHRQoL) showed a moderate negative correlation with dental caries experience and gingival bleeding among HSI participants [Table 3]. Multivariate linear regression analysis revealed age, gender (Model 1), degree of hearing impairment, and communication barriers (Model 2) to be significant predictors of OHRQoL, while gingival bleeding (Model 3) was found to be a significant predictor of OHRQoL [Table 4].

Table 1: Sociodemographic distribution of study participants.

Variable	HSI group, n (%)	Non-HSI group, n (%)	P-value
Age (years)			
10–12	148 (49.3)	160 (53.3)	0.327
13–15	152 (50.7)	140 (46.7)	
Mean age (years)	12.7 ± 1.52	12.21 ± 1.32	
Gender			
Male	156 (52)	161 (53.7)	0.683
Female	144 (48)	139 (46.3)	
Socioeconomic status (according to the Modified Kuppuswamy scale)			
≥Lower middle	134 (44.7)	208 (69.3)	<0.001
<Lower middle	166 (55.3)	92 (30.7)	

HSI: Hearing and speech impairment

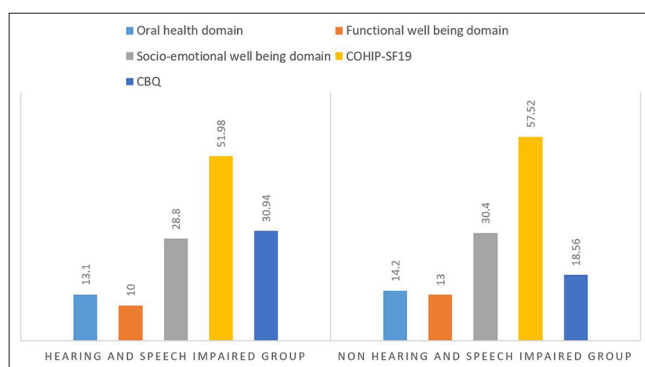


Figure 1: Mean Communication Barriers Questionnaire and Child Oral Health Impact Profile - Short Form-19 scores.

DISCUSSION

HSI constitutes one of the major components of children with special healthcare needs (CSHCN).^[9] CSHCNs have equal rights to good oral health as any other citizen of the country.^[17] However, unfortunately, due to their condition and lack of awareness toward oral health, dental diseases get undiagnosed in these children, leading to the accumulation of high unmet demand for dental care later in life.^[18] Dental treatment is the greatest unmet health need of the handicapped child.^[19] This statement was substantiated by various studies done globally on special children such as hearing and speech impaired.^[19-21] The current study was conducted to assess how communication barriers influence both oral health status and OHRQoL in children with HSIs. Previous studies had no comparison group, whereas the present study considered a comparison group who were selected from regular schools.

The age group of participants in earlier studies ranged from 5 to 30 years.^[5,7-9,11] The participants' age group in the present

study was 10–15 years with a mean age of 12.45 ± 1.42 years. Gender differences in HSI are well established. According to the National Institute on Deafness and Communication Disorders, males were twice as likely to experience hearing loss compared to females.^[22] The present study observed a higher prevalence of HSI among males (52%) than females (48%), though the difference was not statistically significant. This male predominance is consistent with findings from earlier studies. Ghannam *et al.*,^[23] assessed OHRQoL using

pediatric OHRQoL (POHRQoL), which showed a mean POHRQoL score of 6.4 ± 2.89 , with the majority reporting concerns such as avoiding smiling, being worried about attractiveness, and being unhappy with appearance. It also revealed a strong positive significant correlation of POHRQoL with DMFT and GI scores. The present study assessed OHRQoL using COHIP-SF 19 and demonstrated a significant difference between the HSI and non-HSI participants for COHIP-SF 19 scores and all its domains. The present study revealed a moderate negative correlation between communication barriers and OHRQoL, while a weak-positive correlation was found between communication barriers and oral health parameters.

Communication barriers among HSI participants were not assessed in the previous studies. The present study demonstrated a significant difference between HSI and non-HSI participants for CBQ scores. Previous studies revealed a higher prevalence of dental caries among HSI participants which ranged from 39% to 93%.^[5,7-9,11] The present study indicated a higher prevalence of dental caries (70.7%) among children with HSI when compared to non-HSI group (44%) which falls in line with previous studies. Previous studies reported a prevalence of gingival bleeding which ranged from 23% to 84%.^[5,8,9,11,24] A notably higher prevalence of gingival bleeding ($\approx 50\%$) was observed among children with HSI when compared to non-HSI participants ($\approx 19\%$) in the present study, with the mean number of teeth showing gingival bleeding being 3.25 ± 3.92 and 1.4 ± 3.28 among HSI and non-HSI participants, respectively. This may be attributed to inadequate oral hygiene practices and communication barriers that might hinder effective oral health education and routine oral care among those with HSI.

Previous studies revealed a prevalence of fluorosis in the range of 19^[24] to 27.6%.^[9] In the present study, the prevalence of dental fluorosis among HSI and non-HSI participants was 5% and 2.3%, respectively. Regional variations in

Table 2: Comparison of oral health status between HSI and non-HSI participants.

Oral health status	HSI group	Non-HSI group	P-value
Dental caries experience			
DMFT=0	88 (29.3)	168 (56)	<0.001*
DMFT \geq 1	212 (70.7)	132 (44)	
Mean DT	3.55 \pm 3.57	1.39 \pm 2.43	<0.001 [†]
Mean MT	0.05 \pm 0.27	0.02 \pm 0.14	0.072 [†]
Mean FT	0.09 \pm 0.5	0.17 \pm 0.54	0.038 [†]
Mean DMFT	3.68 \pm 3.57	1.57 \pm 2.56	<0.001 [†]
Gingival bleeding			
Absent	152 (50.7)	244 (81.3)	<0.001*
Present	148 (49.3)	56 (18.7)	
Mean number of teeth with gingival bleeding	3.25 \pm 3.92	1.4 \pm 3.28	<0.001 [†]
Dental fluorosis			
Absent	285 (95)	293 (97.7)	0.082*
Present	15 (5)	7 (2.3)	
Dental trauma			
Absent	246 (82)	287 (95.7)	<0.001 [†]
Present	54 (18)	13 (4.3)	

*Chi-square test, [†]Independent sample *t*-test. HSI: Hearing and speech impairment, DT: Decayed teeth, MT: Missing teeth, FT: Filled teeth, DMFT: Decayed, missing, filled teeth

Table 3: Correlation between communication barriers, oral health status, and OHRQoL among HSI participants.

Correlation	HSI group					
	Oral health domain	Functional well-being	Socio-emotional well-being	COHIP-SF 19 score	DMFT	Gingival bleeding
CBQ score	-0.282 [†]	-0.405 [†]	-0.386 [†]	-0.413 [†]	0.294 [†]	0.199*
Oral health domain	-	0.612 [†]	0.579 [†]	0.829 [†]	-0.321 [†]	-0.320 [†]
Functional well-being		-	0.656 [†]	0.832 [†]	-0.315 [†]	-0.352 [†]
Socio-emotional well-being			-	0.910 [†]	-0.270 [†]	-0.290 [†]
COHIP-SF 19 score				-	-0.342 [†]	-0.362 [†]
DMFT					-	0.135*

*Correlation is significant at 0.05 level (2-tailed). [†]Correlation is significant at 0.01 level (2-tailed). HSI: Hearing and speech impairment, DMFT: Decayed, missing, filled teeth, CBQ: Communication barriers questionnaire, OHRQoL: Oral health-related quality of life, COHIP-SF 19: Child Oral Health Impact Profile - Short Form 19

Table 4: Multivariate linear regression analysis with COHIP-SF 19 as the dependent variable among HSI participants.

Models	Unstandardized B	Effect size	P-value	95% confidence interval for B	
				Lower bound	Upper bound
Model 1					
(Constant)	24.973		<0.001	15.307	34.639
Age	1.733	0.291	<0.001	1.109	2.357
Gender	5.264	0.290	<0.001	3.358	7.170
SES	-0.873	-0.063	0.238	-2.326	0.579
Model 2					
(Constant)	48.326		<0.001	38.371	58.281
Age	1.027	0.172	<0.001	0.479	1.575
Gender	4.495	0.247	<0.001	2.870	6.120
SES	0.213	0.015	0.739	-1.040	1.466
Degree of hearing impairment	1.682	0.198	<0.001	0.906	2.459
CBQ	-0.739	-0.471	<0.001	-0.882	-0.595
Model 3					
(Constant)	48.161		<0.001	38.239	58.083
Age	1.054	0.177	<0.001	0.507	1.601
Gender	4.789	0.264	<0.001	3.176	6.402
SES	0.014	0.001	0.982	-1.244	1.272
Degree of hearing impairment	1.797	0.211	<0.001	1.026	2.567
CBQ	-0.698	-0.455	<0.001	-0.842	-0.554
DMFT	-0.196	-0.077	0.089	-0.422	0.030
Gingival bleeding	-0.283	-0.122	0.01	-0.497	-0.070

HSI: Hearing and speech impairment, DMFT: Decayed, missing, filled teeth, CBQ: Communication barriers questionnaire, COHIP-SF 19: Child Oral Health Impact Profile - Short Form 19, SES: Socioeconomic status

fluoride concentration in drinking water, differences in fluoride exposure from other sources (such as toothpaste or supplements), or variations in study populations can be attributed to dental fluorosis. Previous studies showed a dental trauma prevalence which ranged from 3%^[9] to 8%^[24] among those with HSI. However, in the present study, the prevalence of dental trauma among HSI and non-HSI participants was 18% and 4.3%, respectively. The elevated frequency in the HSI group in the present study could be attributed to factors such as compromised motor coordination, limited environmental awareness, and communication difficulties that may hinder effective risk avoidance.

A study by Ghannam *et al.*,^[23] revealed a strong positive significant correlation of POHRQoL with DMFT and gingival bleeding scores. The present study revealed a moderate negative correlation of COHIP-SF 19 with dental caries and gingival bleeding. This difference from the previous study could be attributed to the differences in the tools used for measuring OHRQoL. However, the correlation between all three variables, namely communication barriers, oral health status, and OHRQoL, has not been reported in previous

studies. The present study found that children with HSI who experienced greater communication barriers were more likely to exhibit poorer OHRQoL and an increased likelihood of gingival bleeding. Communication difficulties may hinder their ability to report symptoms, comprehend oral hygiene instructions, and effectively interact with caregivers and dental professionals, resulting in inadequate oral care and poorer clinical outcomes. In addition, COHIP-SF 19 scores demonstrated a moderate negative correlation with caries experience and gingival bleeding, indicating that declining oral health is associated with reduced OHRQoL. However, the moderate strength of this association suggests that other psychosocial factors – such as emotional well-being, social interaction, and parental perception – also play an important role in influencing quality of life.

Multivariate regression can predict how response variables will behave based on changes in predictor variables. Therefore, multivariate regression allows one to have a different view of the relationship between various variables from all the possible angles.^[25] Previous studies have not performed multivariate linear regression analysis to control

for confounders/third variables. In the current study, 3 models were employed in multivariate linear regression analysis. Age and gender were found to be significant predictors of OHRQoL in all 3 models. Degree of hearing impairment and communication barriers were found to be significant predictors of OHRQoL in models 2 and 3. Gingival bleeding was found to be a significant predictor of OHRQoL in model 3.

To the best of our knowledge, this is the first study to determine the association of communication barriers with oral health status and OHRQoL among hearing and speech-impaired children. Performing multivariate linear regression analysis to determine the predictors of OHRQoL adds strength to the study. The study incorporated children across Bengaluru city from various special schools, government, aided, and private schools. Hence, the results of the current study may be generalizable to a similar population. However, the limitations of our study include a cross-sectional study design and the bias which would be inherent in questionnaire studies. In future, longitudinal studies are required to establish causal relationships and to ascertain the role of communication barriers and oral health status on OHRQoL of hearing and speech impaired children. The role of digital technologies, such as mobile applications or assistive devices, in enhancing oral health education and service delivery among HSI individuals needs to be assessed.

CONCLUSION

There is a robust association of communication barriers and oral health status with OHRQoL among children with HSI. These findings highlight the pressing need for customized oral health programs, enhanced communication approaches within dental care environments, and greater awareness among parents and educators. Incorporating oral health education and regular dental screenings into special education curricula could be instrumental in reducing disparities and promoting the overall health and quality of life of this underserved group.

Ethical approval: The research/study was approved by the Institutional Review Board at Government Dental College and Research Institute, Bengaluru, number GDCRI/IEC-ACM(2)/01/2023-24, dated May 15, 2023.

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