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Assessment of Knowledge, Attitude and Practice on Gum Disease among General Population in Bangladesh - A Cross-sectional Study

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Abstract

Background

Gum diseases, encompassing gingivitis and periodontitis, remain a major yet under-recognized public health burden, particularly in low- and middle-income countries where population-level data on oral health behavior are scarce. This study assessed the knowledge, attitude, and practice (KAP) related to gum health among the general adult population of Bangladesh and identified sociodemographic determinants of each domain.

Methods

A nationwide cross-sectional survey was conducted between December 2025 and June 2026 across all eight administrative divisions of Bangladesh. Using convenience sampling, 1,000 adults aged 18 years and above were interviewed with a pre-tested, semi-structured questionnaire covering sociodemographic characteristics and the four KAP components. Knowledge, attitude, and practice scores were each dichotomized using pre-defined cutoffs, and associations with sociodemographic variables were examined through chi-square tests, univariable and multivariable logistic regression, and correlation analysis in STATA 17.

Results

Among 1000 participants, only 30.6% of respondents demonstrated good knowledge, 25.2% held a positive attitude, and 42.7% reported good practice regarding gum health. Mean scores were 4.03 ± 2.44 for knowledge, 20.31 ± 5.10 for attitude, and 6.05 ± 2.36 for practice, with modest but significant positive correlations among the three domains ($r = 0.33–0.54$, $p < 0.001$). Sex, age, administrative division, employment status, and family income were each significantly associated with all three KAP outcomes ($p < 0.001$), whereas religion showed no association. Substantial disparities emerged across divisions, with Dhaka consistently showing the most favorable KAP profile and Barishal the poorest. Higher household income, student status, and employment independently predicted better knowledge, attitude, and practice in adjusted models, with the strongest effect seen for high income and good practice (adjusted OR = 7.67).

Conclusions

These findings reveal considerable gaps and marked regional and socioeconomic inequities in gum health awareness and behaviors across Bangladesh. Targeted oral health education emphasizing basic preventive messages such as proper brushing, interdental cleaning, and early recognition of gingival bleeding is warranted, particularly for low-income populations and lagging divisions. Being a cross-

sectional, convenience-sampled design, causal inference is a limitation, underscoring the need for larger, representative, and clinically validated studies.

Introduction

Gum diseases, also known as periodontal diseases, are a significant global public health problem because of the high prevalence and wide-ranging systemic implications and health effects associated with them (1, 2). They are the results of a pathologically complex bacterial plaque and bacterial biofilms that build up on tooth surfaces and the adjacent gingival margins and are a wide-ranging clinical spectrum(3). This spectrum includes gingivitis, as a localized and reversible inflammation of the soft gingival tissues, and periodontitis, as progressive and irreversible destruction of the periodontal ligament and supporting alveolar bones of the dentition(3). Left untreated, periodontitis is the leading cause of tooth loss in adults worldwide and has a significant impact on masticatory function, nutrition and psychosocial health (3). In addition to local oral destruction, recent periodontal research has proven that periodontopathogens and their inflammatory mediators are able to enter the systemic circulation and therefore contribute to various systemic disorders, especially cardiovascular disease and diabetes mellitus (1, 2). Therefore, the management of these diseases is no longer considered solely a problem of individual patients and a clinical challenge but has become a crucial public health action to be taken worldwide (1, 4).

Although significant progress has been achieved in modern dental clinical care and therapeutic approaches, periodontal diseases remain a significant public health burden in the world. This ongoing burden is seldom due to limited clinical choices but is largely attributable to the widespread oral health literacy deficits, suboptimal self-care and ineffective behavior seeking care in the public domain (4, 5). However, contemporary dental strategies must focus more on proactive oral health promotion and less on reactive interventions to reduce this serious public health problem (2). Most periodontal diseases can be easily prevented or controlled at an early stage when people maintain good daily oral hygiene, which includes mechanical control of plaque through proper toothbrushing, interdental brushes, flossing and actively look out for early clinical signs, like gum bleeding when brushing (2). These daily routines are rooted in individual attitudes, and developing positive oral health attitudes is the most important aspect in preventing irreversible bone loss and achieving long-term periodontal health (2).

Knowledge, Attitude, and Practice (KAP) surveys have proven to be useful diagnostic tools to systematically evaluate public perceptions, determine specific cognitive barriers, and analyze daily oral hygiene habits in public oral health (2, 5, 6). Periodontal disease is a progressive condition with a cumulative severity as the age increases, so it is important to assess KAP for all ages in order to design public health interventions for life courses (2, 3, 5). Such studies are not only used to quantify what people know but also to reveal areas of significant public information gaps, deep-rooted cultural misconceptions and practical or socioeconomic obstacles to adopting appropriate oral hygiene habits (2, 3, 5). Oral health knowledge is consistently high among dentists and medical students but is often low among the general public (2, 4, 7).

In order to effectively design such strategies, public health researchers need to acknowledge that oral health KAP is not fixed, but instead, it dynamically changes over a complex set of socio-demographic, behavioral, and environmental factors. These differences are also compounded by the distinct infrastructure and culture in developing countries like Bangladesh. Bangladesh community-based evidence suggests that place of residence (geographic location and rural-urban) and informal health service providers (local patent medicine shops and pharmacies) are three major predisposing and enabling factors for oral health services utilization. Most of the Bangladeshi population is using dental services after they are needed, as a result of acute pain or significant dysfunction. This reactive pattern is an expression of a lack of oral health literacy in prevention, which is continually influenced by personal traits, access to health services, and social and environmental conditions (8).

The lack of fit between behaviour and knowledge is especially worrying among younger groups, because behaviour adopted in adolescence and the early years of adulthood is very predictive of health status in adulthood. Good oral health is an integral part of general systemic health and working with the oral health needs of adolescents in developing, rural environments is an important step to interrupt the cycle of chronic periodontal disease. Without robust socio-epidemiological data that accurately represent the baseline knowledge, attitudes and practices of rural, resource-limited populations, however, designing and implementing successful preventive dentistry program in these areas is not possible in Bangladesh. Absence of baseline data means that public health planners are unable to create educational campaigns that are engaging to the target group or that tackle the practical barriers that face the target group (9).

In addition, a comprehensive framework of social-demographic, behavioural and communicative factors is needed to assess periodontal KAP. Factors such as educational level and geographic location are known to directly influence health literacy levels, whereas certain aspects of everyday lifestyle, such as how often they brush their teeth, floss, and use mouthwash, directly affect clinical treatment outcomes. An interesting behavioural paradox exists, however, many people may be able to identify the obvious signs of dental decay, like bleeding gums, but are highly unlikely to seek professional attention until the problem becomes extremely painful. This highlights the powerful role of external social and communicative networks. Parental supervision in childhood, exposure to health messages in the media and proactive counseling by dental professionals play an important role in establishing preventive behaviour, and are therefore important factors in initiating behaviour change. To make sense of these interwoven factors, their dismemberment is necessary to understand the shift from knowledge to actual use in everyday life (10).

The disease burden of periodontal disease is undeniable in Bangladesh, however, there is a very significant gap in the literature of comprehensive empirical evidence about the Knowledge, Attitudes, and Practices (KAP) of the general adult population of Bangladesh regarding periodontal disease. The results of KAP studies in other countries, sometimes even in very specific subgroups. They are not applicable in the general context of Bangladesh because of the significant socio-cultural differences, different gender dynamics, differences in health literacy, financial constraints and the high reliance on informal healthcare providers including local pharmacies. Addressing specific KAP gaps and their

underlying socio-demographic influences in the local population is vital for the development of effective public oral health interventions and prevention educational campaigns (11).

Therefore, the present study was designed to explore the Knowledge, Attitude, and Practices (KAP) about gum diseases among Bangladeshi adult population in a nationally representative sample of general adult population in Bangladesh systematically in order to fill this important gap in literature. To determine the specific cognitive, cultural and structural barriers to effective oral self-care and utilization of dental services by the professionals, this research is designed to adopt a rigorous, cross-sectional approach across all eight divisions of the country. Finally, the empirical foundation provided by this study will give public health policymakers, clinicians and community leaders the diagnostic information they need to help them develop, execute and assess targeted educational campaigns and sustainable, community-based interventions to enhance oral health and alleviate the national burden of periodontal disease.

Methodology

The national-wide cross-sectional study adopted a quantitative method to evaluate the knowledge, attitude, and practice (KAP) about the health of gums and periodontal disease among the adult general population of Bangladesh. The study was conducted from December 2025 to June 2026 across the eight administrative divisions of Bangladesh: Barishal, Chattogram, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet. The inclusion criteria of participating in this study were being an adult of 18 years or above residing in Bangladesh and willing to participate in the study. Both men and women participants were included. A total number of 1,000 individuals were considered in this study. Persons with cognitive problems or those under psychiatric medication that might affect their understanding of the questionnaire were excluded from participation. Convenience sampling was the technique used to select the participants. After data collection, cleaning, and determining participant eligibility, 1,000 participants remained for analysis after excluding 152 participants with incomplete data.

Questionnaire and KAP assessment

The data collection process was conducted using a semi-structured questionnaire designed to assess respondents' sociodemographic characteristics and KAP regarding gingival health and periodontal diseases. The sociodemographic section was developed by the research team. The knowledge and attitude items were adapted from (12), and the practice items were adapted from (13), with some items from these two sources excluded as they were not contextually relevant to the Bangladeshi population. The resulting instrument was pre-tested, translated into Bengali, and back-translated into English to ensure linguistic and conceptual accuracy. The English version is provided as Additional File 1.

The final questionnaire contained four sections – Sociodemographic Profile, Knowledge, Attitude, and Practice. The sociodemographic profile included data on the participants’ sex, age, religion, employment status, education, and monthly family income.

Assessment of the level of knowledge related to gingival health was done through eight questions that were designed on aspects of healthy/unhealthy gingiva, the role of plaque and bacteria in causing gingival inflammation, gingival bleeding, and preventive measures such as brushing and use of dental floss. Three possible responses to each question were “Yes,” “No,” and “I do not know.” The correct answer was given one point while wrong and “I do not know” responses were given zero points for each question with a maximum knowledge score of 8. In the last part of the data analysis, respondents were classified as having poor and good knowledge groups based on the predetermined cutoff value of the study.

The attitudes of the participants towards their gum health as well as preventive oral health practices were examined through the administration of ten statements regarding brushing technique and behavior, replacement of toothbrushes, use of dental floss and mouthwash, dental visits, scaling, and seeking professional help when experiencing bleeding gums. Responses to the items were scored based on a four-point Likert scale which had “strongly disagree” to “strongly agree” endpoints. The scores for the individual respondents were then calculated using the pre-defined criteria and the participants were classified into either negative or positive attitudes groups.

Gingival health practices were evaluated based on 10 items covering their dental visit in the past, healthcare seeking behavior for toothache or gingival problems, reason for their dental visit, oral hygiene instruments, frequency of brushing teeth, brushing teeth per day, tongue cleaning, brushing duration, toothbrush replacement, and other aids for oral hygiene. Their responses were scored based on the predetermined scoring system, and an overall practice score was obtained. Respondents were classified as having poor or good practice depending on the cut-off used in the analysis.

The internal consistency of the KAP domains was assessed using Cronbach's alpha coefficients. The Cronbach's alpha coefficients were 0.779 for the knowledge scale, 0.862 for the attitude scale, and 0.552 for the practice scale.

Data collection and quality assurance

Data were collected through interviews conducted face-to-face with the use of the pre-tested semi-structured questionnaire. In order to encourage participation and accessibility, the questionnaire was developed in English as well as Bengali languages and was administered in both paper as well as online format through Google forms. Training of the research team as well as data collectors was organized before the data collection. Training was based on the objectives of the study, recruitment of the participants, procedure of informed consent, administering the questionnaire, conducting interview and the data collection process.

Several measures were taken to ensure the quality of the data. Standard protocol of research of the Department of Public Health, North South University was followed in the study. Pre-testing, translation and simplification of the questionnaire used in the research was done in the initial phase itself.

Supervision and guidance for the study were continuously provided by the Principal Investigator and Co-Principal Investigator throughout the study..The data obtained was validated with respect to its reliability and validity. In order to avoid errors and achieve consistency, researchers engaged in data collection, data cleaning, and data analysis processes.

Statistical analysis

Data coding, cleaning, and analysis were done with the use of STATA version 17. Descriptive statistics were used to describe the sociodemographic characteristics of the participants and their KAP towards gingival health and gum diseases. Categorical data were expressed as frequencies and percentages.

KAP outcomes were converted into binary outcomes using the set criterion for scoring the KAP outcomes. Those who scored ≥ 70% in their knowledge about gingival health and gum disease were considered to have good knowledge about these diseases while those who scored less than 70% had poor knowledge. Those who scored ≥ 24 were considered to have a positive attitude towards the problems under investigation while those who scored less than 24 had a negative attitude towards them. Those who scored ≥ 6.048 in their practice were considered to have good practice while those who scored < 6.048 had poor practice. [Here 6.048 was the mean practice score]

Pearson's chi-square test was applied to investigate the relationship between socio-demographic factors of the participants and their knowledge, attitude, and practice outcomes. Univariable binary logistic regression was performed independently for each dichotomous variable: good knowledge (yes or no), positive attitude (yes or no), and good practice (yes or no). Initially, univariable binary logistic regression was performed by including each independent variable in the model. Multivariable binary logistic regression analysis was conducted to identify predictors of good knowledge, positive attitude, and good practice, with independent variables entered into the model simultaneously. Results were expressed as crude odds ratio (COR), adjusted odds ratio (AOR) along with their respective 95% confidence interval (CI) and p-value.

Correlation analysis was done to evaluate the correlations between knowledge, attitude, and practice outcomes. The association between selected independent variables and KAP outcome was evaluated by using linear regression analysis. All statistical analyses were two-sided and p-value of less than 0.05 was considered as statistically significant.

Result

The study sample consisted of 1,000 participants from the general population of Bangladesh. Of these, 59.4% were male and 40.6% were female. The participants were aged 18–29 years (53.1%), 30–49 years (22.0%), 50–59 years (14.6%), and more than 60 years (10.3%). Participants were from all 8 divisions, Dhaka and Chattogram had the highest number of participants (15.2% each). Most participants were Muslims (79.1%). The largest employment group was students (39.9%) followed by employed

participants (27.9%) Family income Regarding family income, 33.4% reported monthly family income of BDT 25,000–50,000 and 33.2% reported less than BDT 25,000. (Table 1)

Table 1
Sociodemographic characteristics of the participants (N = 1,000)

Variable	Category	Frequency	Percentage
Sex	Male	594	59.4
	Female	406	40.6
Age	18–29 years	531	53.1
	30–49 years	220	22.0
	50–59 years	146	14.6
	≥ 60 years	103	10.3
Division	Chattogram	152	15.2
	Dhaka	152	15.2
	Barishal	130	13.0
	Sylhet	134	13.4
	Khulna	60	6.0
	Mymensingh	132	13.2
	Rajshahi	145	14.5
	Rangpur	95	9.5
Religion	Muslim	791	79.1
	Hindu	197	19.7
	Others	12	1.2
Employment	Unemployed	105	10.5
	Employed	279	27.9
	Students	399	39.9
	Homemaker	94	9.4
	Others	123	12.3
Family income	< 25,000 BDT	332	33.2
	25,000–50,000 BDT	334	33.4
	50,000–100,000 BDT	266	26.6
	> 100,000 BDT	68	6.8

In Table 2, the total number of participants with good knowledge was 30.6%, and poor knowledge was 69.4%. Only 25.2% had a positive attitude, while 74.8% had a negative attitude. About practice, 42.7% had good practice and 57.3% had poor practice.

Table 2
Overall knowledge, attitude and practice levels

KAP domain	Level	Frequency	Percentage
Knowledge	Poor	694	69.4
	Good	306	30.6
Attitude	Negative	748	74.8
	Positive	252	25.2
Practice	Poor	573	57.3
	Good	427	42.7

Sex was significantly associated with knowledge, attitude and practice. Good knowledge was more common among females (37.9%) than males (25.6%) and good practice was also higher among females (50.0%) than males (37.7%). Age was significantly associated with all the three KAP domains ($p < 0.01$). The proportion of good knowledge and positive attitude generally decreased with increasing age. The highest proportion of good knowledge (42.2%) and positive attitude (28.8%) was found among participants aged 18–29 years. (Table 3)

There were also large regional differences. Division was significantly associated with knowledge ($\chi 2 = 100.99$, $p < 0.001$), attitude ($\chi 2 = 83.96$, $p < 0.001$) and practice ($\chi 2 = 71.39$, $p < 0.001$). Dhaka had the highest percentage of good knowledge (52.0%) and Barishal had the lowest percentage of good knowledge (6.2%). The highest positive attitude was found in Sylhet (41.0%) and the lowest in Barishal (1.5%). Dhaka had the highest (53.9%) and Barisal had the lowest (16.2%) good practice. (Table 3)

Employment status and family income were also significantly associated with each of the three KAP outcomes ($p < 0.001$). Students had a higher proportion of good knowledge (45.1%), positive attitude (31.1%) and good practice (53.9%) than several other employment groups. In general, better KAP outcomes were observed in participants with higher family income. However, religion had no significant association with knowledge ($p = 0.590$), attitude ($p = 0.911$) or practice ($p = 0.200$). (Table 3)

Table 3
Association between sociodemographic characteristics and KAP levels

Variable	Knowledge χ^2 (p)	Attitude χ^2 (p)	Practice χ^2 (p)
Sex	17.30 (< 0.001)	4.75 (0.029)	14.89 (< 0.001)
Age	81.22 (< 0.001)	14.28 (0.003)	51.67 (< 0.001)
Division	100.99 (< 0.001)	83.96 (< 0.001)	71.39 (< 0.001)
Religion	1.06 (0.590)	0.19 (0.911)	3.22 (0.200)
Employment status	97.60 (< 0.001)	50.76 (< 0.001)	91.52 (< 0.001)
Family income	23.17 (< 0.001)	28.69 (< 0.001)	70.27 (< 0.001)

From the total data of 1,000 participants, the mean scores for knowledge, attitude, and practice were 4.03 ± 2.44 (range: 0–8), 20.31 ± 5.10 (range: 10–40), and 6.05 ± 2.36 (range: 0–13), respectively (Table 4).

Correlation and reliability of knowledge, attitude, and practice measures

Pairwise analysis showed positive correlations across all three KAP domains. Knowledge was positively correlated with attitude ($r = 0.331$, $p < 0.001$) and practice ($r = 0.543$, $p < 0.001$). A positive correlation was also observed between attitude and practice ($r = 0.387$, $p < 0.001$) (Table 4).

In Table 4, the knowledge scale, consisting of eight items, had a Cronbach's alpha of 0.7788. The 10-item attitude scale showed higher internal consistency ($\alpha = 0.8618$), while the 10-item practice scale had a lower reliability coefficient ($\alpha = 0.5522$).

Table 4
Descriptive statistics and internal consistency of knowledge, attitude, and practice measures (N = 1,000) and pairwise correlations.

Variable	Observation	Mean	Std. Dev.	Min	Max	No. of items	Cronbach's α
Knowledge score	1000	4.034	2.437	0	8	8	0.7788
Attitude score	1000	20.314	5.095	10	40	10	0.8618
Practice score	1000	6.048	2.364	0	13	10	0.5522

Variable	Knowledge	Attitude	Practice
Knowledge score	1.000		
Attitude score	0.331 (0.000)	1.000	
Practice score	0.543 (0.000)	0.387 (0.000)	1.000

Factors associated with good knowledge

Multivariable logistic regression showed that division, religion, employment status, and monthly family income were associated with good knowledge (Table 5). Compared with Chattogram, Dhaka was associated with greater odds of good knowledge (OR = 2.09, 95% CI: 1.23–3.56, p = 0.007), whereas lower odds were observed for Barishal (OR = 0.26, 95% CI: 0.11–0.65, p = 0.004), Sylhet (OR = 0.49, 95% CI: 0.28–0.85, p = 0.01), Khulna (OR = 0.12, 95% CI: 0.05–0.30, p < 0.001), and Rajshahi (OR = 0.52, 95% CI: 0.30–0.9, p = 0.02). Hindu religion (OR = 1.56, 95% CI: 1.02–2.38, p = 0.042) and student status (OR = 2.307, 95% CI: 1.16–4.56, p = 0.017) were positively associated with good knowledge. Monthly family incomes of BDT 50,000–100,000 (OR = 1.59, 95% CI: 1.02–2.49, p = 0.042) and above BDT 100,000 (OR = 2.38, 95% CI: 1.25–4.52, p = 0.008) were also associated with greater odds of good knowledge.

Factors associated with positive attitude

Compared to Chattogram, participants from Barishal (OR = 0.08, 95% CI: 0.02–0.35, p = 0.001) and Mymensingh (OR = 0.29, 95% CI: 0.15–0.58, p < 0.001) had lower odds of a positive attitude, while those from Sylhet had higher odds (OR = 2.09, 95% CI: 1.21–3.62, p = 0.009). Participants aged 30–49 years had greater odds than those aged 18–29 years (OR = 1.95, 95% CI: 1.10–3.45, p = 0.021). Employment (OR = 3.58, 95% CI: 1.58–8.12, p = 0.002), student status (OR = 4.38, 95% CI: 1.84–10.40, p = 0.001), and monthly family income above BDT 100,000 (OR = 3.90, 95% CI: 2.05–7.42, p < 0.001) were positively associated with positive attitude. (Table 5)

Factors associated with good practice

In the analysis, participants from Khulna had lower odds of good practice than those from Chattogram (OR = 0.30, 95% CI: 0.15–0.61, p = 0.001). In contrast, employed participants (OR = 2.62, 95% CI: 1.42–4.82, p = 0.002) and students (OR = 3.22, 95% CI: 1.68–6.17, p < 0.001) had higher odds than unemployed participants. The largest association was observed for monthly family income > BDT 100,000 (OR = 7.67, 95% CI: 3.87–15.21, p < 0.001). (Table 5)

Table 5
Multivariable logistic regression analysis of factors associated with good knowledge, positive attitude, and good practice (N = 1,000)

Characteristic	Good knowledge Adjusted OR (95% CI)	p-value	Positive attitude Adjusted OR (95% CI)	p-value	Good practice Adjusted OR (95% CI)	p-value
Division						
Chattogram	Ref	—	Ref	—	Ref.	—
Dhaka	2.091 (1.229–3.556)	**0.007**	1.738 (1–3.021)	0.05	1.605 (0.955–2.699)	0.074
Barishal	0.264 (0.107–0.65)	**0.004**	0.076 (0.017–0.345)	**0.001**	0.736 (0.368–1.472)	0.387
Sylhet	0.488 (0.282–0.845)	**0.01**	2.087 (1.205–3.616)	**0.009**	1.53 (0.903–2.593)	0.114
Khulna	0.118 (0.046–0.302)	**< 0.001**	0.485 (0.218–1.08)	0.076	0.304 (0.152–0.61)	**0.001**
Mymensingh	0.661 (0.382–1.142)	0.138	0.29 (0.146–0.577)	**< 0.001**	0.7 (0.413–1.187)	0.186
Rajshahi	0.515 (0.295–0.9)	**0.02**	1.435 (0.841–2.45)	0.186	0.941 (0.57–1.554)	0.813
Rangpur	1.071 (0.599–1.915)	0.818	1.457 (0.796–2.668)	0.222	0.736 (0.415–1.304)	0.293
Sex						
Male	Ref	-	Ref	-	Ref	-
Female	1.263 (0.902–1.77)	0.174	1.078 (0.764–1.522)	0.668	1.375 (0.997–1.898)	0.053
Age group						
18–29 years	Ref.	—	Ref.	—	Ref.	—
30–49 years	1.25 (0.73–2.153)	0.42	1.95 (1.104–3.445)	**0.021**	1.105 (0.665–1.835)	0.7
50–59 years	0.639 (0.34–1.197)	0.162	1.751 (0.939–3.265)	0.078	1.433 (0.834–2.463)	0.193
> 60 years	0.429 (0.17–1.08)	0.072	1.437 (0.614–3.363)	0.403	0.584 (0.281–1.213)	0.149
Religion						
Muslim	Ref.	—	Ref.	—	Ref.	—

Characteristic	Good knowledge Adjusted OR (95% CI)	p-value	Positive attitude Adjusted OR (95% CI)	p-value	Good practice Adjusted OR (95% CI)	p-value
Division						
Hindu	1.555 (1.02–2.376)	**0.042**	1.527 (0.991–2.352)	0.055	1.074 (0.732–1.574)	0.716
Others	1.042 (0.25–4.373)	0.955	0.987 (0.241–4.048)	0.986	1.36 (0.38–4.85)	0.634
Employment status						
Unemployed	Ref.	—	Ref.	—	Ref.	—
Employed	1.097 (0.57–2.11)	0.78	3.578 (1.577–8.12)	**0.002**	2.62 (1.424–4.822)	**0.002**
Students	2.303 (1.16–4.561)	**0.017**	4.38 (1.844–10.403)	**0.001**	3.217 (1.676–6.174)	**< 0.001**
Homemaker	0.558 (0.24–1.306)	0.179	1.339 (0.499–3.589)	0.562	1.425 (0.669–3.035)	0.359
Others	0.244 (0.08–0.721)	**0.011**	1.461 (0.524–4.073)	0.469	0.931 (0.441–1.964)	0.85
Monthly family income (BDT)						
Less than 25,000	Ref.	—	Ref.	—	Ref.	—
25,000–50,000	0.865 (0.57–1.305)	0.49	0.851 (0.556–1.301)	0.457	1.403 (0.963–2.046)	0.078
50,000–100,000	1.591 (1.02–2.487)	**0.042**	1.361 (0.864–2.145)	0.184	2.447 (1.606–3.729)	**< 0.001**
> 100,000	2.379 (1.25–4.517)	**0.008**	3.9 (2.05–7.42)	**< 0.001**	7.67 (3.87–15.212)	**< 0.001**
Constant	0.347 (0.154–0.784)	**0.011**	0.065 (0.024–0.176)	**< 0.001**	0.177 (0.081–0.387)	**< 0.001**

Ref= reference category, CI= Confidence interval, BDT= Currency of Bangladesh

To compare crude and adjusted associations, only factors that remained statistically significant in the multivariable models are presented below. Crude odds ratios (ORs) are from the corresponding

univariable logistic regression models, while adjusted odds ratios (AORs) are from the multivariable models.

Table 6
Univariable and multivariable logistic regression results for factors significant after adjustment (N = 1,000)

Outcome	Characteristic	Comparison	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Good knowledge	Division	Dhaka vs Chattogram	1.448 (0.922–2.277)	0.108	2.091 (1.229–3.556)	**0.007**
		Barishal vs Chattogram	0.088 (0.040–0.192)	**< 0.001**	0.264 (0.107–0.650)	**0.004**
		Sylhet vs Chattogram	0.611 (0.376–0.994)	**0.047**	0.488 (0.282–0.845)	**0.010**
		Khulna vs Chattogram	0.149 (0.060–0.367)	**0.031**	0.118 (0.046–0.302)	**< 0.001**
		Mymensingh vs Chattogram	0.582 (.356-.951)	**.031**	0.661 (0.382–1.142)	0.138
		Rajshahi vs Chattogram	0.349 (0.209–0.584)	**< 0.001**	0.515 (0.295-0.900)	**0.02**
		Rangpur vs Chattogram	0.817 (0.483–1.38)	0.449	1.071 (0.599–1.915)	0.818
	Religion	Hindu vs Muslim	0.848 (0.6-1.198)	0.35	1.555 (1.02–2.376)	**0.042**
		Others vs Muslim	0.73 (0.196–2.719)	0.639	1.042 (0.25–4.373)	0.955
	Employment	Student vs Unemployed	4.255 (2.441–7.415)	**< 0.001**	2.303 (1.16–4.561)	**0.017**
		Homemaker vs Unemployed	1.143 (0.546–2.392)	0.723	0.558 (0.24–1.306)	0.179
	Family Income	BDT 25,000–50,000 vs < 25,000	1.04 (.735 – 1.47)	0.827	0.865 (0.57–1.305)	0.49
		BDT 50,000-100,000 vs < 25,000	1.751 (1.234–2.483)	**0.002**	1.591 (1.02–2.487)	**0.042**

Outcome	Characteristic	Comparison	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
		>BDT 100,000 vs < 25,000	2.74 (1.604–4.681)	**< 0.001**	2.379 (1.25–4.517)	**0.008**
Positive attitude	Division	Barishal vs Chattogram	0.04 (0.009–0.167)	**< 0.001**	0.076 (0.017–0.345)	**0.001**
		Sylhet vs Chattogram	1.765 (1.078–2.889)	**0.024**	2.087 (1.205–3.616)	**0.009**
		Mymensingh vs Chattogram	0.325 (0.171–0.618)	**0.001**	0.290 (0.146–0.577)	**< 0.001**
	Age	30–49 vs 18–29 years	0.804 (0.561–1.152)	0.234	1.950 (1.104–3.445)	**0.021**
	Employment	Employed vs Unemployed	5.869 (2.736–12.58)	**< 0.001**	3.578 (1.577–8.120)	**0.002**
		Student vs Unemployed	5.467 (2.579–11.59)	**< 0.001**	4.380 (1.844–10.403)	**0.001**
	Family Income	>BDT 100,000 vs < 25,000	3.871 (2.232–6.712)	**< 0.001**	3.900 (2.050–7.420)	**< 0.001**
Good practice	Division	Khulna vs Chattogram	0.319 (0.166–0.614)	**0.001**	0.304 (0.152–0.610)	**0.001**
	Employment	Employed vs Unemployed	4.692 (2.708–8.127)	**< 0.001**	2.620 (1.424–4.822)	**0.002**
		Student vs Unemployed	5.289 (3.099–9.025)	**< 0.001**	3.217 (1.676–6.174)	**< 0.001**
	Family Income	BDT 50,000-100,000 vs < 25,000	2.815 (2.008–3.948)	**< 0.001**	2.447 (1.606–3.729)	**< 0.001**
		>BDT 100,000 vs < 25,000	7.990 (4.348–14.68)	**< 0.001**	7.673 (3.870-15.212)	**< 0.001**

For good knowledge, adjustment strengthened the association for Dhaka, which changed from a non-significant crude OR of 1.448 to an AOR of 2.091, indicating approximately 2.09 times the odds of good knowledge compared with Chattogram. Hindu religion similarly became significant only after adjustment (AOR = 1.555), corresponding to 1.56 times the odds compared with Muslim participants. Students had 4.26 times the crude odds of good knowledge compared with unemployed participants, which decreased to 2.30 times after adjustment. Participants with monthly family income above BDT 100,000 had 2.74 times the crude odds and 2.38 times the adjusted odds of good knowledge compared with those earning below BDT 25,000. Conversely, Barishal, Sylhet, Khulna, Rajshahi, and the other-employment category remained associated with lower odds after adjustment. For positive attitude, employed participants and students had 3.58 and 4.38 times the adjusted odds, respectively, while income above BDT 100,000 was associated with 3.90 times the adjusted odds. The association for age 30–49 years became significant after adjustment (AOR = 1.950). For good practice, employed participants had 2.62 times and students had 3.22 times the adjusted odds compared to unemployed participants. The strongest association was observed for monthly family income above BDT 100,000, with 7.67 times the adjusted odds of good practice compared with income below BDT 25,000. Khulna remained associated with substantially lower odds of good practice (AOR = 0.304, approximately 69.6% lower odds) than Chattogram. (Table 6)

Figure 1 illustrates the distribution of standardized knowledge, practice, and attitude scores among 1,000 participants. Knowledge scores had a mean of 50.43% (SD: 30.47%) and a median of 50.0% (IQR: 25.0–75.0%), demonstrating the greatest variability among the three domains. Practice scores were lower, with a mean of 46.52% (SD: 18.18%) and a median of 46.15% (IQR: 30.77–61.54%). Attitude scores showed the highest central tendency, with a mean of 50.79% (SD: 12.74%) and a median of 52.5% (IQR: 40.0–60.0%), and exhibited the least variability. All three distributions showed minimal skewness. Overall, the findings indicate considerable heterogeneity in knowledge levels, moderate variability in practices, and comparatively more homogeneous attitude scores among participants. The statistics are given below:

KAP domain	Mean ± SD (%)	Median (IQR) (%)	Min–Max (%)
Knowledge	50.43 ± 30.47	50.00 (25.00–75.00)	0–100
Practice	46.52 ± 18.18	46.15 (30.77–61.54)	0–100
Attitude	50.79 ± 12.74	52.50 (40.00–60.00)	25–100

Discussion

The present study identified substantial gaps in oral-health KAP among Bangladeshi adults, 69.4% had poor knowledge, 74.8% had negative attitudes, and 57.3% had poor practices. This is consistent with evidence from South Asian populations, where oral health behaviors are influenced by cultural norms, socioeconomic conditions, and limited preventive awareness (14, 15).

Female participants had significantly higher knowledge and practices than male participants (37.9% vs. 25.6% and 50.0% vs. 37.7%, respectively), consistent with previous research reporting more favorable oral-health knowledge and behaviors among females (16). But studies also showed better gum disease knowledge of men in Taiwan and Malaysia (17, 18). Younger participants also showed better KAP, with the 18–29-year group having the highest good knowledge (42.2%) and positive attitude (28.8%), which shows a greater prevalence of formal education and health information. Whereas a study in Malaysia indicates the mean level of periodontal disease knowledge was low and was not influenced by age (18).

Marked regional disparities were observed, with Dhaka showing the highest good knowledge (52.0%) and practice (53.9%), whereas Barishal had the lowest (6.2% and 16.2%, respectively). Such differences may reflect unequal access to education, healthcare facilities, and socioeconomic resources. National evidence confirms substantial inequalities in dental-service utilization in Bangladesh, particularly according to education and urban residence (8, 19).

Students and participants from higher-income groups consistently demonstrated better knowledge, attitudes, and practices (KAP), highlighting the important role of socioeconomic conditions in shaping oral health behaviors. Similar relationships between higher income and improved oral health knowledge and practices have also been documented in Bangladesh (20).

Religion was not significantly associated with any of the KAP domains, indicating that socioeconomic and demographic characteristics may have a greater influence on oral health-related knowledge, attitudes, and practices within this population. Evidence from Bangladesh indicates that structured oral-health education can substantially enhance knowledge, attitudes, and practices, emphasizing the need for targeted interventions within communities and educational settings (21, 22).

In the current study, sex was a significant predictor of all three KAP domains, with females exhibiting greater good knowledge (37.9% vs. 25.6%) and good practice (50.0% vs. 37.7%) than males. This result is similar to a cross-sectional study conducted in China on 514 patients with periodontal disease, 60.89% of whom were female. The study found that female patients had higher knowledge scores than male patients(23). According to a pilot study conducted among 143 outpatients (89 men and 54 women) at a periodontics clinic in Mangalore, India, female respondents knew more about oral hygiene than male respondents, with no observable age-related pattern(24). However, in a cross-sectional survey of 562 adults in Northeast China (43.06% male and 56.94% female), gender was only significantly correlated with knowledge (P<.05) rather than attitude or practice, and the female advantage was limited to younger respondents; no significant gender gap was found among older participants(25). This suggests that the sex-related benefit of periodontal practice observed throughout the entire study may be moderated by the sampling of the clinical or non-clinical population.

In the present study, knowledge (42.2%) and attitude (28.8%) were highest among the youngest respondents (18–29 years) and declined progressively with increasing age ($p < 0.001$). This trend was not observed in the Northeast China survey where multiple regression analysis revealed that both knowledge and attitude scores tended to increase with age, with the largest increase in the 41–50 year

group (R^2=1.58, 95% CI 0.83–2.33, P<.01). However, practice scores declined with increasing age in that same study(25), similar to the inverse age-practice gradient observed in the current dataset (χ^2=51.67, p < 0.001). The difference in trend of knowledge might be reflecting the educational profile of the youngest Bangladeshi respondents, a large proportion of whom were students at the time of the survey and thus had a more recent exposure to the digital health program.

The present sample of students had the highest proportion of good knowledge (45.1%), positive attitude (31.1%) and good practice (53.9%) of all categories of employment (χ 2 = 97.60, p < 0.001 for knowledge). This contrasts with a multicentre survey of 514 patients with periodontal disease in China where multivariate logistic regression found student status to be an independent predictor of poor practice compared to other occupational groups (adjusted OR = 0.43, 95% CI 0.20–0.92, p = 0.029) together with housewife status (adjusted OR = 0.41, 95% CI 0.17–0.95, p = 0.037) (23). A similar association between socio-economic status and periodontal practice was reported in Jinan, China, among 563 periodontal-disease patients where a monthly household income of 10,000–20,000 yuan independently associated with good practice (adjusted OR = 0.476, 95% CI 0.258–0.877, p = 0.017) along with an occupation in the commercial/service sector (adjusted OR = 0.488, 95% CI 0.221–1.080, p = 0.007) (26), further supporting the findings of this study that showed a positive income gradient across all three KAP domains (χ^2 = 23.17–70.27, p < 0.001).

Periodontal knowledge in Bangladesh's general population is similar to the average found in the other Asian national KAP surveys. In the case of China, out of 50,991 Chinese adults, only 20% were classified as having periodontal knowledge. Self-reported periodontal practices in the study were poor. Only 2.6% flossed daily and 6.4% of participants reported consulting a dentist because of bleeding gums. In that study, the same trends as these were found with gender, age, place of residence and family income(27). This pattern is similar to the current findings of significant division-level (χ^2=100.99, p < 0.001) and family-income-related (χ^2=23.17–70.27, p < 0.001).

The significant regional variation found here from 52.0% in Dhaka to 6.2% in Barishal further suggests that oral health resources and access to dental care are not equally distributed throughout Bangladesh's divisions. Knowledge (p = 0.590), attitude (p = 0.911), and practice (p = 0.200) were not significantly correlated with religion, indicating that religion did not account for variations in KAP in this investigation.

There was a positive correlation between knowledge, attitude, and practice. When compared to knowledge-attitude (r = 0.331) and attitude-practice (r = 0.387), the strongest correlation was found between knowledge and practice (r = 0.543, p < 0.001). The 514 Chinese periodontal patients showed similar but generally weaker correlations: knowledge was associated with attitude (r = 0.31, p < 0.001) and practice (r = 0.23, p < 0.001), and attitude was associated with practice (r = 0.17, p < 0.001)(23). The knowledge scale's reliability was acceptable (α = 0.7788), attitude's reliability was high (α = 0.8618), and practice's reliability was lower (α = 0.5522), suggesting that the practice items might need more testing. Factual knowledge may have a relatively greater influence on self-reported oral hygiene behavior outside

of a clinical population already receiving periodontal care, according to the stronger knowledge-practice relationship found in the current general population sample.

Periodontal diseases constitute a major public-health concern because they are highly prevalent, contribute to tooth loss and impaired quality of life, and share modifiable risk factors with other noncommunicable diseases. This nationwide cross-sectional study identified substantial socioeconomic and geographical inequalities in gum-disease-related knowledge, attitude, and practice among the general population of Bangladesh. After multivariable adjustment, division, employment status, and household income were consistently associated with one or more KAP domains. These findings suggest that periodontal-health promotion in Bangladesh should move beyond uniform awareness campaigns and incorporate equity-oriented, geographically responsive, and economically accessible strategies (28).

A pronounced income gradient was observed, particularly for preventive practices. Compared with participants from households earning below BDT 25,000 per month, those with household incomes of BDT 50,000–100,000 and above BDT 100,000 had significantly higher odds of good knowledge. The association was even stronger for practice: participants in the highest-income category had 7.67 times higher adjusted odds of good practice. High-income participants also had 3.90 times greater odds of a positive attitude. This dose-responsive pattern indicates that economic resources may influence periodontal health not only through affordability of toothbrushes, toothpaste, interdental aids, and professional care, but also through health literacy, exposure to health information, and access to preventive dental services. However, as income, education, residence, and healthcare access are closely interrelated, income should not be interpreted as an independent causal determinant in isolation.

Our results are consistent with evidence from other settings showing that socioeconomic advantage is associated with better periodontal knowledge and preventive orientation. In Tehran, higher economic status and university education were associated with better periodontal-health knowledge, while positive preventive attitudes were associated with higher knowledge scores and university education (29). Likewise, a nationally representative Chinese study involving 50,991 adults reported that periodontal KAP was associated with income, education, place of residence, age, sex, smoking status, and history of periodontal disease(30). The present results extend this evidence to Bangladesh and show that socioeconomic inequality may be especially pronounced for translating knowledge and favourable attitudes into daily preventive practices.

The strong association between household income and practice is relevant in the Bangladeshi context, where regular preventive dental attendance remains uncommon. Analysis of nationally representative WHO STEPS data found that although 46.1% of Bangladeshi adults reported cleaning their teeth at least twice daily, only 1.07% reported visiting a dentist for a routine check-up; dental attendance was predominantly driven by pain or oral problems (2). Therefore, a high reported frequency of tooth cleaning should not be assumed to represent comprehensive periodontal self-care. Interventions should promote both effective plaque-control behaviours including appropriate toothbrushing technique and interdental

cleaning where indicated and timely professional consultation for bleeding gums, calculus, halitosis, tooth mobility, or other periodontal symptoms.

Employment status was another important correlate. Compared with unemployed participants, students had greater adjusted odds of good knowledge (AOR = 2.30), positive attitude (AOR = 4.38), and good practice (AOR = 3.22). Employed participants also demonstrated higher odds of positive attitude (AOR = 3.58) and good practice (AOR = 2.62). The pattern among students may reflect exposure to school- or university-based health information, digital media, peer networks, and greater familiarity with preventive health messages. The favourable attitude and practice among employed participants may partly reflect financial autonomy, workplace social networks, and a higher likelihood of accessing private or institutional healthcare. However, employment categories are heterogeneous; the “employed” group may include participants with widely varying educational attainment, occupation type, health insurance status, and urban residence. Consequently, these associations should be interpreted as markers of social position and opportunity rather than direct effects of employment itself.

The finding that students had favourable outcomes across all three KAP domains supports the potential value of educational institutions as platforms for periodontal-health promotion. Curriculum-integrated oral-health education, campus-based screening, social-media messaging, and peer-led demonstrations of toothbrushing and interdental plaque control could reinforce preventive practices at an early stage of adulthood. Nevertheless, interventions should not be restricted to students or employed groups, as unemployed individuals and lower-income households may have the greatest unmet preventive needs. Community health workers, primary-care facilities, and local media may be particularly important for reaching these populations.

Significant interdivisional differences were observed after adjustment. Compared with participants from Chattogram, those from Dhaka had higher odds of good knowledge, whereas those from Barishal, Sylhet, Khulna, and Rajshahi had lower odds. Positive attitude was lower in Barishal and Mymensingh but higher in Sylhet. Khulna participants had substantially lower odds of good practice than those from Chattogram (AOR = 0.30). These findings indicate that national averages may conceal important subnational inequalities in periodontal awareness and preventive behaviour. Regional differences may reflect variation in urbanisation, educational opportunity, density and distribution of oral-health services, affordability of care, local health-promotion activities, cultural norms, and differential exposure to health information. However, these explanatory mechanisms were not measured in the present analysis; therefore, the observed geographical associations should be interpreted as signals for further investigation rather than evidence that residence itself causes poor KAP.

The regional findings are broadly compatible with recent evidence that dental-service utilization in Bangladesh is socially and geographically patterned. A national study found that urban residence and recent contact with a healthcare provider were associated with dental-service utilization, whereas living in the northern region was associated with lower utilization (31). Thus, the lower knowledge and practice observed in selected divisions may partly reflect inequitable availability, accessibility, or use of dental

services. Future studies should incorporate urban–rural residence, distance to dental facilities, out-of-pocket expenditure, dental insurance coverage, prior dental visits, and availability of oral-health professionals to clarify the pathways underlying regional disparities.

Participants aged 30–49 years had higher odds of positive attitude than those aged 18–29 years, although age was not significantly associated with good knowledge or good practice after adjustment. This may indicate that middle-aged adults have greater perceived susceptibility to gum problems or more experience of oral symptoms, but that such awareness does not necessarily translate into improved self-care. In the Bangladesh STEPS analysis, older age was associated with more frequent tooth cleaning and more recent dental visits, although the direction and magnitude of age associations differed by oral-health outcome(8). Differences between studies may be due to variation in outcome definitions, sampling strategies, and the distinction between general oral hygiene and gum-disease-specific knowledge, attitude, and practice.

Female sex was not independently associated with good knowledge, positive attitude, or good practice in the current models. This differs from some population-based studies reporting more favourable oral-hygiene behaviours among women(32). Such inconsistency may reflect adjustment for income, employment, and division in the present analysis, or may indicate that sex differences in Bangladesh are more apparent for specific behaviours, such as brushing frequency or dental attendance, than for the composite KAP measures used in this study. Future research should explore sex-specific barriers to preventive periodontal care, including household decision-making, financial autonomy, caregiving responsibilities, and access to oral-health information.

Hindu participants had higher adjusted odds of good knowledge than Muslim participants (AOR = 1.56, 95% CI: 1.02–2.38), but religion was not significantly associated with attitude or practice. This estimate should be interpreted cautiously because the confidence interval was close to the null value and the unadjusted association was not statistically significant. The apparent association after adjustment is compatible with confounding by socioeconomic, educational, occupational, or geographical characteristics. It would be inappropriate to attribute this difference to religion itself without detailed information on education, income, locality, cultural practices, health literacy, and service access. Religion should therefore be treated as a contextual social variable that warrants additional investigation rather than as a target for explanatory assumptions or intervention.

Comparison of crude and adjusted estimates provides further insight into confounding. For example, the association between residence in Dhaka and good knowledge became statistically significant only after adjustment, increasing from a crude OR of 1.45 to an AOR of 2.09. Similarly, the Hindu–Muslim comparison became significant after adjustment. These changes suggest that the crude estimates were influenced by differences in the distribution of other covariates. In contrast, the association between student status and good knowledge attenuated from a crude OR of 4.26 to an AOR of 2.30, indicating that part of the crude association may be explained by correlated characteristics such as younger age and higher household income. Most notably, the association between high income and good practice

remained large after adjustment, declining only slightly from a crude OR of 7.99 to an AOR of 7.67. This persistence highlights household economic position as a potentially important marker of inequality in periodontal self-care.

The findings have important implications for public-health programming. First, gum disease education should be integrated into primary healthcare, noncommunicable disease services, and diabetes care, given the established links between poor oral hygiene, diabetes self-care, and periodontal disease. In a multicentre Bangladeshi study of adults with type 2 diabetes, adherence to oral-hygiene practices was strongly associated with lower odds of periodontal disease. Second, programs should prioritize lower-income households, unemployed individuals, and divisions with lower adjusted odds of good knowledge or practice, particularly Khulna, Barishal, and Mymensingh. Third, communication should focus on actionable periodontal messages: bleeding gums are not normal; plaque and calculus require prevention and, when necessary, professional management; twice-daily brushing alone may be insufficient without correct technique and interdental cleaning; and dental visits should not occur only after pain develops. These actions are aligned with the World Health Organization's strategy to integrate oral health within universal health coverage and noncommunicable disease prevention(21).

Several limitations should be considered. The cross-sectional design precludes causal inference and cannot determine whether higher income, employment, or favourable attitudes preceded better practices. KAP outcomes were likely self-reported and may therefore be affected by recall and social-desirability bias. In addition, the presented regression models did not include several potentially important determinants, including educational attainment, urban–rural residence, tobacco use, diabetes status, previous dental visits, periodontal symptoms, dental-care cost, and proximity to services. Residual confounding is therefore possible. The wide confidence intervals for some regional estimates, particularly Barishal, suggest limited precision and indicate that division-specific comparisons should be interpreted with caution. Finally, odds ratios may overstate the relative magnitude of association when an outcome is common; future analyses could report adjusted prevalence ratios as a sensitivity analysis.

Despite these limitations, this study provides important evidence on social and geographical inequalities in gum-disease-related knowledge, attitudes, and practices among Bangladeshi adults. The findings indicate that improving periodontal health will require more than individual-level education. Equity-focused interventions that improve oral-health literacy, affordability, preventive dental attendance, and access to care across underserved socioeconomic and geographical groups are required to reduce disparities in periodontal-health behaviour.

Conclusion

This cross-sectional study found notable differences in knowledge, attitude and oral health practices related to gum health and periodontal disease among adults in Bangladesh. Higher family income was associated with better knowledge, more favorable attitudes and better oral health practices. Employment and student status were also linked with better KAP in some areas. Further differences between the

eight divisions of Bangladesh were observed regarding oral health awareness and practice. The findings of this study suggest the need for creating public awareness about periodontal diseases and promoting oral health practices particularly among the poor and those from low-income groups with poor areas with poorer KAP. The oral health education program should focus on very simple oral health messages such as cleaning your teeth with a toothbrush properly, cleaning between your teeth regularly, recognize the bleeding of your gums as signs of gum disease and treat it before it gets worse and go to a dentist. As it was a cross-sectional study using convenience sampling therefore no cause-effect relationship could be established. Study findings therefore would not hold true for the whole population of Bangladesh. Further studies using large samples and clinical examination are needed to better understand the factors affecting periodontal health in Bangladesh.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethical Review Committee of North South University (Approval No. #2025/OR- NSU/IRB/0822, dated 26/10/2025) before initiation. The study objectives and procedures were explained to the eligible participants and informed consent was obtained before data collection. Participation was voluntary and participants were free to refuse to answer or to withdraw at any time. Data collection, management and analysis were undertaken in a manner that protected participant privacy and confidentiality. The ethical guidelines established in the 1964 Declaration of Helsinki and its subsequent amendments were followed. All participants were recruited and data were collected in Bangladesh. One co-author's affiliation changed to a US institution after data collection was completed.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

M.N.T.: Conceptualization, methodology, and design of the cross sectional KAP survey on gum disease; development and validation of the structured questionnaire; coordination of data collection from the general population; data cleaning, formal analysis, and interpretation of knowledge, attitude, and practice findings; writing – original draft of the manuscript; and final approval of the version to be published.T.M.: Conceptualization, data entry and curation, interpretation of results related to gum disease knowledge, attitude, and practice domains, critical revision of the manuscript for important intellectual content, and final approval.B.C.: Data entry and curation, interpretation of results related to gum disease knowledge, attitude, and practice domains, critical revision of the manuscript for important intellectual content, and final approval.S.S.I.: Data entry and curation, interpretation of results related to gum disease knowledge, attitude, and practice domains, critical revision of the manuscript for important intellectual content, and final approval.F.B.N.: Participant recruitment and data collection, data curation, interpretation of findings, critical revision of the manuscript, and final approval.T.H.: Statistical analysis plan, advanced data analysis, interpretation of associations between sociodemographic factors and gum disease KAP outcomes, critical revision of the manuscript, and final approval.S.S.P.: Participant recruitment and data collection, data curation, interpretation of results, critical revision of the manuscript, and final approval.A.N.O.: Participant recruitment and data collection, data curation, interpretation of findings, critical revision of the manuscript, and final approval.M.M.R.M.: Participant recruitment and data collection, data curation, interpretation of results, critical revision of the manuscript, and final approval.A.B.: Participant recruitment and data collection, data curation, interpretation of findings,

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Data Availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Figures

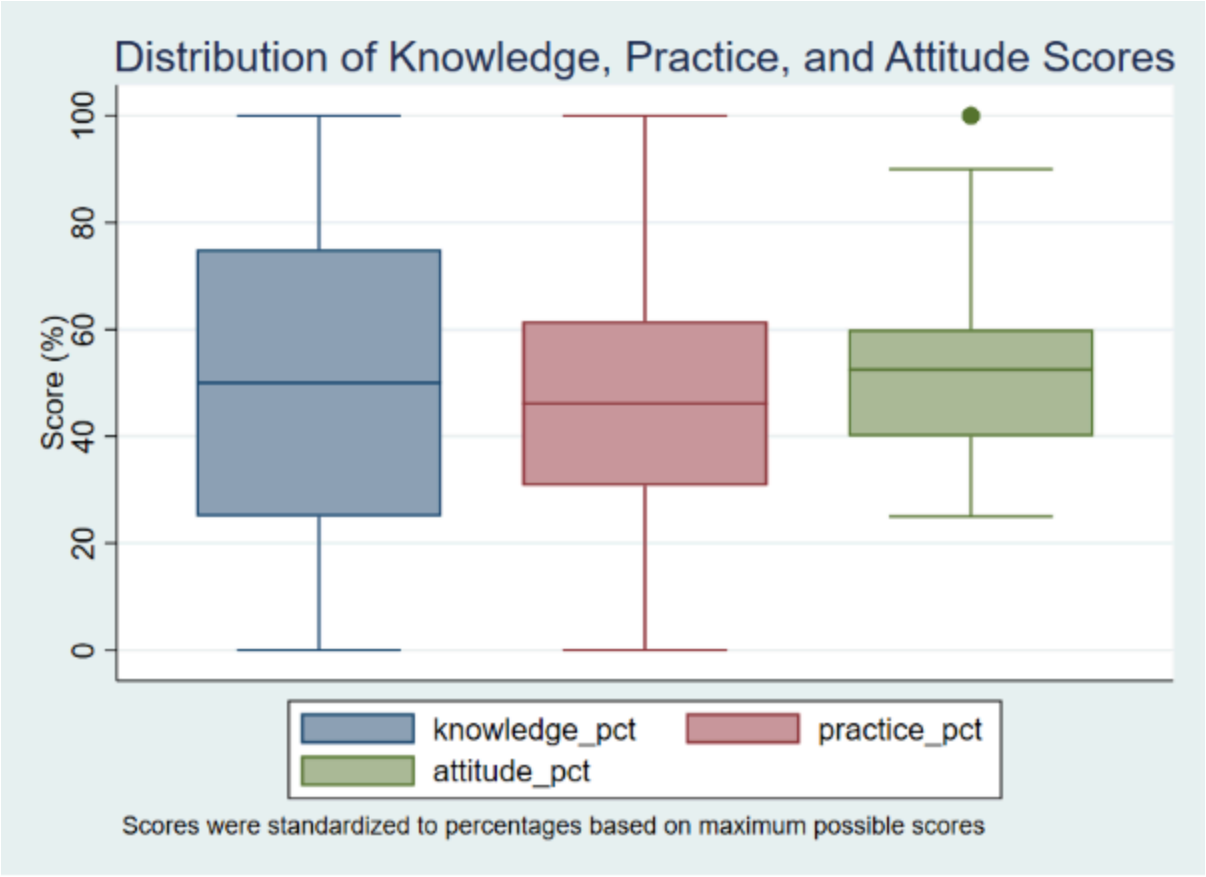


Figure 1

Distribution of standardized Knowledge, Practice, and Attitude scores among study participants (n = 1,000). *[The boxes represent the interquartile range (IQR), the horizontal lines within the boxes represent the median, the whiskers represent the distribution beyond the IQR, and the dot indicates an outlier. All scores were standardized to a 0–100% scale]*