

Factors Associated with Utilization of Dental Health Services in Erbil Governorate, Iraq: A Cross-Sectional Study

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Abstract

Objective: Poor oral health is an important public health problem. The current study aims to examine the use of dental health services and to identify the associated factors among individuals attending dental units within primary health care centers (PHCCs) in Erbil Governorate, Kurdistan Region of Iraq.

Methods: A cross-sectional study included users (above 18 years old) who attained dental unit within PHCCs in Erbil governorate. Data collection began on the 10th of October 2024 and continued until the 20th of February 2025. PHCCs that do not contain dental units, specialized dental centers and private oral health clinics and centers were excluded from this study. R software was used for statistical analyses. A $P < 0.05$ was considered statistically significant.

Results: The study included 1,100 participants (mean age 35.9 years; 49.4% male). Nearly a half (10.5%) reported frequent (monthly) visits to dental clinics, mainly for pain (55.8%). Preference for private clinics (39%) was the main reason for non-utilization. Participants with older age, rural residents, no formal education, no employment, students and those with chronic diseases had significantly higher odds of frequent visits.

Conclusion: The findings of this study demonstrated that most participants had a moderate utilization of dental services and largely motivated by pain rather than preventive care. There is a need for strategies to improve health education, build trust, and enhance service quality to increase utilization.

Keywords: Dental health services, health services utilization, primary health care, Iraq

Introduction

According to the World Health Organization (WHO), the health system as “all the organizations, institutions, resources, and personnel whose primary purpose is to promote, restore, and maintain health.” Since oral health is essential to the overall health, it is considered a basic human right and should be integrated into both healthcare services for the community and preventive as well as educational initiatives.¹

Oral diseases can sometimes lead to serious health issues and adversely affect overall quality of life. They can also contribute to tooth pain, impair chewing and speech, create aesthetic concerns, and result in psychosocial challenges. In children, inadequate oral hygiene is often linked to pain, infections, and difficulties with eating. In addition, the oral diseases could be caused by socioeconomic conditions, the availability and accessibility of oral healthcare services.²

Poor oral health is a crucial burden to the public health. Globally, higher prevalence and incidence of poor oral health, in particular in low- and middle-income countries, with the greatest challenge being on the disadvantaged and the socially marginalized. Also, dental health care is important to prevent and treat oral disease; hence to the identification of factors can act as facilitators or barriers to utilization and is important.³

Dental care utilization refers to the percentage of the individuals accessing dental services in a given period.⁴ Routine dental visits is crucial in the prevention, identification, and treatment of dental health problems, thereby enhancing life quality at both individual and community levels.⁵

Understanding the determinants of dental healthcare utilization is important for guiding health systems and developing

policies to enhance service delivery and the oral health status of populations.⁵ Therefore, the current work assesses the utilization of dental health services and to identify the associated factors among users attending dental units within primary health care centers in Erbil Governorate, Iraq.

Methods

Study Design and Population

A cross-sectional study included users (above 18 years old) who attained dental unit within PHCCs in Erbil governorate. Data collection began on the 10th of October 2024 and continued until the 20th of February 2025. The study population consisted of individuals attending selected oral health service centers (PHCCs). As such, the sample consists of health-care-seeking individuals rather than the general population.

The study excluded PHCCs with no dental units, specialized dental centers and private oral health clinics and centers.

Sample Size and Sampling Technique

The study used Epi Info software to calculate the required sample size based on default values of an expected rate of 50 %, a population size, confidence interval of 95%, and an acceptable margin of error 3%. The study calculated the minimum size of the sample as 1066 participants, to account for non-responses, the final sample size rounded to 1100.

A two-stage sampling approach was employed. In the first stage, oral health service centers (clusters) were selected using simple random sampling. Of the total 22 centers, across four health districts in Erbil governorate (10 in Erbil city,

5 in Dashty Hawler, 4 in Khabat, and 3 in Shaqlawa), approximately 25% of centers in each district were randomly selected.

The second stage recruited participants, by a convenience sampling approach, from attendees at the selected centers during the data collection period. All eligible individuals attending the selected centers were invited to participate until reaching the required sample size.

Study Instrument

The questionnaire was developed for the purpose according to a comprehensive review of the previous literature.⁶⁻¹⁰ Items were adapted and synthesized from relevant studies to construct a structured instrument. Interview with users (face-to-face) were used for data collection.

The tool included six categories of questions: the first category related to demographic characteristics. This category contains variables (age, sex, level of education, monthly income, residence place, marital status, and occupation).

The second asked two questions about health status. It asked "do you have any oral disease?" and if the answer were yes, "which type of oral diseases do you have?". The second question was "do you have chronic disease?" If yes, "which chronic disease do you have?".

The third was to assess knowledge level of participants of dental services. The items were "do you know about the services in the dental unit in the primary health care" such as laboratory, sterilization, dental x-ray, education, case refers, school health, and oral-maxillofacial rehabilitation services. Response options were yes and no.

The fourth included 13 statements from strongly agree to strongly disagree with statements to assess attitude of the participants towards dental services.

The fifth was about utilization of oral health services: "how many times do you visit the dental unit". Then the main reasons to the visit and not visit PHC. The answer was open ended.

The sixth was about the satisfaction of participant about dental services, this section was 14 statements with answers from strongly satisfied to strongly dissatisfied.

The instrument has been submitted to academics and clinical experts for review. Five experts in various medical specialties were included, in order to evaluate and add modification to the contents, clarity and adequacy to conduct this study. A pilot study was carried out with 30 sample (not included in this study). The study reliability was examined using Cronbach's alpha which revealed that the values were 0.75 for the knowledge scale, 0.73 for the attitude scale, and 0.76 for the satisfaction scale, indicating acceptable internal consistency.

Statistical Analysis

R software version 4.5.0 and RStudio were used for the statistical analysis.

The knowledge of dental services was assessed using eight items. Each item was coded as 1 for correct knowledge ("Yes") and 0 for incorrect or absent knowledge ("No"). Then, the study calculated the total knowledge score by summing responses across all items, producing a score range of 0–8, with higher scores indicating greater knowledge.

Attitudes toward dental services were measured using 13 statements rated on a 5-point Likert scale ranging from

strongly disagree to strongly agree. A total attitude score was computed by summing item responses, with possible scores ranging from 13 to 65, where higher scores reflect more positive attitudes.

Satisfaction with dental services was assessed using 14 items rated on a 5-point Likert scale from strongly dissatisfied to strongly satisfied. The total was calculated by summing item responses, with scores ranging from 14 to 70, with higher scores indicating greater satisfaction. The study considers all scores as continuous variables in descriptive and inferential analyses.

Quantitative variables were summarized using mean $\pm$ standard deviation (SD). Categorical variables were summarized as frequencies and percentages. The associations between the categorical variables were assessed using Pearson's Chi-square test. For comparisons involving continuous variables, the Mann-Whitney U test (two groups) or Kruskal-Wallis test (more than two groups) was applied, as appropriate.

To identify factors associated with utilization of dental services (categorized as infrequent, moderate, and frequent), ordinal logistic regression models were fitted using a hierarchical approach. Model 1 was about socio-demographic variables (age, gender, residence, marital status, education level, and occupation). Additionally Model 2 included health-related variables (chronic disease and oral disease). Model 3 further included behavioral variables (knowledge, attitude, and satisfaction scores). Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

The Brant test and the Wolfe-Gould test were used to assess the proportional odds assumption. The Brant test indicated statistically significant violations of the proportional odds assumption across all models (omnibus $P < 0.001$). Consistent findings were observed using the Wolfe-Gould test, with several predictors demonstrating significant non-parallel effects, indicating that the proportional odds assumption was not fully satisfied.

Given these findings, multinomial logistic regression was additionally performed as a sensitivity analysis, which does not require the proportional odds assumption. The results were broadly consistent in direction and magnitude with those obtained from ordinal logistic regression, supporting the robustness of the findings.

Akaike Information Criterion (AIC), log-likelihood values, and pseudo- R^2 statistics were used to how to what extent does the Model fit. Statistical significance was set at $P < 0.05$.

Results

General Characteristics of Participants

Table 1 explains the features of the study participants ($N = 1100$). The mean age was 35.9 years ($SD = 14.6$), and nearly half of the participants were male (49.4%). Also, most of the participants (35.5%) had completed postgraduate education. The majority resided in urban areas (86.9%). Over half of the participants were married (56.8%), and the majority were governmentally employed (32.5%), followed by student (18.9%). Then, 69.5% reported presence of oral health condition, whereas 32.5% reported presence of chronic disease.

Regarding dental health services, the mean total knowledge score was 2.1 ± 2.8 , the mean attitude score 36.4 ± 8.4 ,

Table 1. General characteristics of study participants

Characteristic	Overall (N = 1100)
Age (years)	
Mean ± SD	35.9 ± 14.5
(Min, Max)	(18.0, 89.0)
Sex, n (%)	
Male	543 (49.4%)
Female	557 (50.6%)
Educational level, n (%)	
Illiterate	72 (6.5%)
Read and write	162 (14.7%)
Primary	78 (7.1%)
Secondary	148 (13.5%)
Institute	103 (9.4%)
College	146 (13.3%)
Post graduate	391 (35.5%)
Residence, n (%)	
Urban	956 (86.9%)
Rural	144 (13.1%)
Marital status, n (%)	
Single	371 (33.7%)
Married	625 (56.8%)
Widow	53 (4.8%)
Divorced	51 (4.6%)
Occupation, n (%)	
Non-employee	135 (12.3%)
Housewife	125 (11.4%)
Private sector	125 (11.4%)
Retired	23 (2.1%)
Student	208 (18.9%)
Self-employee	126 (11.5%)
Governmental employee	358 (32.5%)
Oral disease, n (%)	
Yes	764 (69.5%)
No	336 (30.5%)
Chronic disease, n (%)	
Yes	357 (32.5%)
No	743 (67.5%)
Knowledge level	
Mean ± SD	2.1 ± 2.8
(Min, Max)	(0.0, 8.0)
Attitude level	
Mean ± SD	36.4 ± 8.4
(Min, Max)	(13.0, 65.0)
Satisfaction level	
Mean ± SD	39.8 ± 8.7
(Min, Max)	(14.0, 69.0)

and the mean satisfaction score 39.8 ± 8.7 . Details of knowledge, attitude, and satisfaction items are presented (Supplementary Table S1, Table S2, and Table S3).

Utilization of Dental Health Services

Table 2 shows the utilization of dental health services among participants. Nearly half (47.1%) reported moderate visiting dental clinics (about six times per year), 42.5% were infrequent visits (once annually), and 10.5% had frequent visits (monthly). The most common reason for visiting was pain or problems with teeth, gums, or mouth (55.8%), followed by treatment or follow-up (16.4%), consultation (14.3%), routine check-up (10.1%), not recalling the reason (2.7%), and other purposes (0.7%).

Some did not visit dental units because they prefer private clinics or hospitals (39%), followed by lack of trust in services (12.4%), poor quality of treatment (12.2%), financial constraints (11.3%), language barriers (10.5%), long distances (7.2%), long waiting times (6.6%), and other reasons (0.8%).

Association Between General Characteristics and Utilization of Dental Health Services

Table 3 presents the distribution of visits category across study characteristics. Age groups showed a statistically significant association with visits frequency ($P < 0.001$). Participants in the age group (44–89 years) showed higher frequent visits (21.0%).

Table 2. Dental Health Services Utilization

Characteristic	N = 1,100
How many times visit dental unit, n (%)	
Frequent (Monthly)	115 (10.5%)
Moderate (About 6 times/year)	518 (47.1%)
Infrequent (One time/year)	467 (42.5%)
Why you visit dental unit, n (%)	
Consultation/advise	157 (14.3%)
Pain or trouble with teeth, gums or mouth	614 (55.8%)
Treatment/follow-up treatment	180 (16.4%)
Routine check-up/treatment	111 (10.1%)
Don't know/don't remember	30 (2.7%)
Other purpose	8 (0.7%)
Why you not visit dental unit, n (%)	
Language barrier	116 (10.5%)
I go to private clinic or hospital	429 (39.0%)
Don't believe dental services	136 (12.4%)
Long distance	79 (7.2%)
Bad quality of treatment	134 (12.2%)
Insufficient financial resources	124 (11.3%)
Waiting long time	73 (6.6%)
Other reasons	9 (0.8%)

Table 3. General characteristics stratified by oral health visits frequency

Characteristics	Visits frequency			P-value*
	Infrequent N = 467	Moderate N = 518	Frequent N = 115	
Age (years), Mean $\pm$ SD	33.3 $\pm$ 11.4	36.3 $\pm$ 15.1	44.9 $\pm$ 18.5	<0.001
Age category, n (%)				<0.001
18–25	133 (45.4%)	139 (47.4%)	21 (7.2%)	
26–33	135 (46.4%)	136 (46.7%)	20 (6.9%)	
34–43	119 (48.8%)	108 (44.3%)	17 (7.0%)	
44–89	80 (29.4%)	135 (49.6%)	57 (21.0%)	
Sex, n (%)				0.018
Male	227 (41.8%)	245 (45.1%)	71 (13.1%)	
Female	240 (43.1%)	273 (49.0%)	44 (7.9%)	
Residence, n (%)				<0.001
Urban	428 (44.8%)	445 (46.5%)	83 (8.7%)	
Rural	39 (27.1%)	73 (50.7%)	32 (22.2%)	
Educational level, n (%)				<0.001
Higher education	308 (48.1%)	283 (44.2%)	49 (7.7%)	
No formal education	56 (23.9%)	147 (62.8%)	31 (13.2%)	
Primary	30 (38.5%)	30 (38.5%)	18 (23.1%)	
Secondary	73 (49.3%)	58 (39.2%)	17 (11.5%)	
Marital status, n (%)				0.044
Married	279 (44.6%)	292 (46.7%)	54 (8.6%)	
Not married	188 (39.6%)	226 (47.6%)	61 (12.8%)	
Occupation, n (%)				<0.001
Employed	296 (48.6%)	272 (44.7%)	41 (6.7%)	
Not employed	79 (30.4%)	139 (53.5%)	42 (16.2%)	
Student	84 (40.4%)	101 (48.6%)	23 (11.1%)	
Retired	8 (34.8%)	6 (26.1%)	9 (39.1%)	
Oral disease, n (%)				0.208
No	149 (44.3%)	160 (47.6%)	27 (8.0%)	
Yes	318 (41.6%)	358 (46.9%)	88 (11.5%)	
Chronic disease, n (%)				<0.001
No	348 (46.8%)	346 (46.6%)	49 (6.6%)	
Yes	119 (33.3%)	172 (48.2%)	66 (18.5%)	
Knowledge score, Mean $\pm$ SD	2.5 $\pm$ 3.0	1.8 $\pm$ 2.6	1.9 $\pm$ 2.5	<0.001
Attitude score, Mean $\pm$ SD	37.3 $\pm$ 7.8	35.3 $\pm$ 8.6	37.4 $\pm$ 9.6	0.002
Satisfaction score, Mean $\pm$ SD	40.1 $\pm$ 8.3	39.1 $\pm$ 8.3	41.4 $\pm$ 11.6	0.059

*P-values are based Pearson's Chi-squared test for categorical variables. Chi-square test with Monte Carlo simulation (2000 replicates) for occupation and education variables. No formal education included illiterate and read and write, Higher education were institute, college and post-graduate, Not married is divided into single, widow and divorced, Employment was private sector, self-employee, governmental employee. Not employed were housewife and unemployed.

In addition, sex significantly associated with visit categories ($P = 0.018$). Male participants showed higher percentage (13.1%) of frequent visits compared to females.

Furthermore, a statistically significant association between educational level and visits categories ($P < 0.001$) was seen. Participant with primary education showed a higher frequent visit (23.1%).

Similarly, the residence area ($P < 0.001$), marital status ($P = 0.044$) and occupation ($P < 0.001$) were significantly related to the visits level. Participants from rural area, not married, and retired showed higher frequent visits. There was statistically significant association between chronic disease status and visits frequency ($P < 0.001$). However, oral

disease status was not significantly associated with visits frequency ($P = 0.208$).

Knowledge and attitude scores were significantly associated with visit frequency ($P < 0.001$ and $P = 0.002$, respectively). The satisfaction score had a borderline association with visit frequencies ($P = 0.059$).

Factors Associated with Dental Health Utilization: Ordinal Logistic Regression

In the univariate analysis, there were significant association between older age, rural residence, no formal education, unemployment, student status, and the presence of chronic disease with higher odds of frequent dental visits. In contrast, higher attitude scores were had a negative correlation with the odds of frequent visits.

In Model 1 (socio-demographic variables), older age, rural residence, no formal education, unemployment, and

student status remained caused higher odds of frequent visits.

In Model 2 (additionally adjusted for health-related conditions), the same associations persisted, and chronic disease emerged as a significant predictor of frequent visits.

In Model 3 (further adjusted for knowledge, attitude, and satisfaction scores), the associations remained largely unchanged, with older age, rural residence, no formal education, unemployment, student status, and chronic disease continuing to show significantly higher odds of frequent visits, as shown in Table 4.

Model fit improved from Model 1 to Model 2, as indicated by a decrease in AIC (2011.4 to 2000.2) and an increase in pseudo- R^2 (McFadden: 0.053 to 0.061). The addition of behavioral variables in Model 3 resulted in only a marginal improvement (AIC = 2002.3; McFadden $R^2 = 0.063$), and the likelihood ratio test comparing Model 2 and Model 3 was not statistically significant ($P = 0.275$).

Table 4. Univariate and multivariate ordinal logistic regression for visits frequency

Dependent: visits frequency	OR (univariable)	Model 1	Model 2	Model 3
Age (years)	1.02 (1.01–1.03, $P < 0.001$)	1.02 (1.01–1.04, $P < 0.001$)	1.02 (1.01–1.03, $P < 0.001$)	1.02 (1.01–1.03, $P = 0.001$)
Sex				
Male	–	–	–	–
Female	0.95 (0.75–1.21, $P = 0.667$)	0.89 (0.68–1.15, $P = 0.373$)	0.91 (0.70–1.19, $P = 0.504$)	0.92 (0.71–1.20, $P = 0.557$)
Residency				
Urban	–	–	–	–
Rural	2.18 (1.49–3.25, $P < 0.001$)	1.55 (1.03–2.37, $P = 0.039$)	1.54 (1.02–2.36, $P = 0.043$)	1.54 (1.02–2.38, $P = 0.043$)
Marital status				
Married	–	–	–	–
Not married	1.23 (0.97–1.57, $P = 0.093$)	1.27 (0.95–1.70, $P = 0.113$)	1.34 (1.00–1.80, $P = 0.053$)	1.34 (0.99–1.81, $P = 0.056$)
Educational level				
Higher education	–	–	–	–
No formal education	2.95 (2.12–4.16, $P < 0.001$)	1.86 (1.29–2.72, $P = 0.001$)	1.86 (1.28–2.72, $P = 0.001$)	1.69 (1.15–2.50, $P = 0.008$)
Primary	1.48 (0.92–2.42, $P = 0.108$)	0.83 (0.48–1.42, $P = 0.493$)	0.83 (0.48–1.43, $P = 0.495$)	0.75 (0.44–1.31, $P = 0.310$)
Secondary	0.95 (0.67–1.36, $P = 0.792$)	0.82 (0.56–1.19, $P = 0.288$)	0.80 (0.55–1.16, $P = 0.239$)	0.75 (0.51–1.10, $P = 0.142$)
Occupation				
Employed	–	–	–	–
Not employed	2.17 (1.60–2.96, $P < 0.001$)	1.79 (1.26–2.55, $P = 0.001$)	1.67 (1.17–2.41, $P = 0.005$)	1.63 (1.14–2.35, $P = 0.008$)
Student	1.40 (1.02–1.93, $P = 0.041$)	1.52 (1.04–2.24, $P = 0.033$)	1.53 (1.04–2.26, $P = 0.030$)	1.52 (1.03–2.24, $P = 0.036$)
Retired	1.77 (0.76–4.46, $P = 0.198$)	0.82 (0.33–2.16, $P = 0.678$)	0.69 (0.27–1.82, $P = 0.432$)	0.72 (0.28–1.91, $P = 0.488$)
Chronic disease				
No	–	–	–	–
Yes	1.76 (1.36–2.30, $P < 0.001$)	–	1.38 (1.02–1.87, $P = 0.035$)	1.36 (1.01–1.84, $P = 0.046$)
Oral disease				
No	–	–	–	–
Yes	1.12 (0.86–1.45, $P = 0.400$)	–	1.20 (0.91–1.58, $P = 0.209$)	1.21 (0.92–1.61, $P = 0.175$)
Knowledge score	0.92 (0.88–0.96, $P < 0.001$)	–	–	0.96 (0.92–1.01, $P = 0.108$)
Attitude score	0.98 (0.96–0.99, $P = 0.002$)	–	–	0.98 (0.96–1.00, $P = 0.127$)
Satisfaction score	0.99 (0.98–1.01, $P = 0.266$)	–	–	1.01 (0.99–1.03, $P = 0.305$)

A sensitivity analysis was performed using multinomial logistic regression to assess the robustness of the ordinal logistic regression findings. Overall, the direction and magnitude of associations were largely consistent between the two modeling approaches. Age, rural residence, lower educational attainment, and occupational status were consistently the cause for higher visit frequency across models. Similarly, chronic disease had a big directional connection to key socio-demographic variables. No substantial reversal of associations was identified, supporting the robustness of the primary ordinal logistic regression results. Accordingly, the ordinal logistic regression model was kept as the main analytical approach due to its parsimony and appropriate handling of the ordinal outcome structure (**Supplementary Table S4**).

Discussion

The present study aimed to assess the knowledge, attitude, satisfaction, and utilization of the users of the dental health services in PHCCs and to identify factors associated with them in Erbil Governorate, Kurdistan Region of Iraq. Regarding utilization of dental health services, approximately ten percent of participants reported frequent dental visits. The most common reasons for visiting dental units were experiencing pain or problems with teeth, gums, or mouth, followed by treatment or follow-up care, consultation or advice. These findings reflected a predominantly treatment-oriented pattern of care.

These results were consistent with a qualitative study in Nigeria which found that the slum residents experience various forms of dental ailments—mostly pain-related. Also, the main barriers to accessing care from dental care facilities were the unaffordability and fear of extreme treatment measures.¹¹ Similarly, prior research reported that only 26.4% of Nigerian adults had visited a dentist at least once, and most visits were treatment-based.¹² In Ethiopia, a study revealed that about 60.3% of household heads had visited a dentist for treatment in the past year, but only 9.9% attended routine checkups.¹³ A meta-analytical data from India reported that dental health service utilization among adults was only 23.96%.¹⁴ Similarly, a study reported that only 20% of adults visited a dentist within the previous year.³

Some people reported preferring private clinics or hospitals than dental units. Others lack trust in dental services, and reported a poor quality of treatment, insufficient financial resources, language barriers, long distances, long waiting times, and other unspecified reasons. According to prior research among children, the most common reason being the absence of perceived dental problems (65.8%), followed by cost-related barriers (22.2%).¹⁵

This study revealed that the participants with older age, no employment, and students, had significantly higher odds of frequent visits. There was a positive association between age and the frequency of dental visits. This could mean that oral health issues accumulate over time. This confirms studies from Iran¹³ and Bosnia and Herzegovina.³ Education, and skilled occupations are also important factors in dental utilization.¹² Further to these factors, income, education, dental insurance, and self-rated oral health propelled people to use dental services.¹³ Moreover, psychosocial stressors and time constraints can act as barriers to seeking routine dental care.^{13,16}

In contrast, higher educational attainment inversely correlated with frequent dental visits possibly because higher education may have had financial constraints, work schedules, or perceived need for care. However, similar findings were explained in a cross-sectional study in India where utilization varied not only by education level but also by geographic location and accessibility of services.¹⁴

This study revealed that the rural participants had significantly higher odds of frequent visits. It could be explained by the structure of primary health care delivery in the study setting showed that rural populations may rely more on publicly provided dental services within primary health care centers rather than private clinics.¹⁷ Additionally, their higher burden of untreated oral disease and delayed care-seeking may lead to more frequent visits once access is obtained.¹⁸ Another possible explanation is chronic conditions, which may increase contact with health services in general, including dental units.

Participants with chronic diseases had significantly higher odds of dental visits confirming the behavioral model of health service utilization (Andersen's Behavioral Model of Health Services Use). This posits that need factors—particularly perceived and evaluated health needs—are the strongest determinants of healthcare use. Such participants typically have a greater contact with health systems, which increases the opportunities for referral and utilization of dental services.¹⁹

In this study, knowledge, attitude, and satisfaction did not play a role in the frequent dental visits after adjustment for socio-demographic and health-related factors. This finding suggests that the awareness and positive perceptions of dental services alone may not be sufficient drivers of utilization behavior in this population. Health service use is likely influenced more strongly by structural and enabling factors such as accessibility, socioeconomic status, and health needs rather than cognitive or perceptual factors.^{19,20} Another possible explanation is that knowledge, attitude, and satisfaction may operate indirectly through other pathways or may be partially mediated by socio-demographic characteristics, which could attenuate their independent effects in multivariable models.

This study is the first of its kind to comprehensively assess the knowledge, attitudes, utilization, satisfaction, and socio-demographic determinants of dental health service utilization in the Kurdistan Region of Iraq. It addresses a critical research gap in the local context. Despite the importance of the information about dental health-care service utilization and its determinants in Kurdistan Iraq, the study has some limitations. First, the use of self-reported responses may be subject to recall bias or social desirability bias. Participants might underreport or overreport their knowledge, attitude, or satisfaction levels. Second, due to the cross-sectional nature of the study, causality cannot be established. Associations found between variables may not reflect directional effects.

Third, participants were recruited exclusively from attendees of primary health care centers (PHCCs), which may introduce selection bias. Individuals who seek care at PHCCs may differ systematically from the general population in terms of health status, health-seeking behavior, and socioeconomic characteristics. Consequently, the findings may not be fully

generalizable to the broader community. Future studies using population-based sampling strategies are recommended to improve external validity.

Fourth, dental service utilization was based on self-reported data, which is subject to recall bias and potential over- or under-reporting of the number of visits. In particular, the frequency of dental visits may be influenced by participants' ability to accurately recall service use over the reference period. Moreover, social desirability bias may have affected responses, making some participants overstate their utilization of dental services.

Conclusions

Most participants had moderate utilization of dental services and largely motivated by pain rather than preventive care. Key factors associated with this utilization were age, rural residence, lack of education, unemployment, chronic diseases and being students. These findings highlight gaps in awareness and preventive use of PHCC dental services and suggest the need for strategies to improve health education, build trust, and enhance service quality to increase utilization.

Ethics Statement

The study obtained approval from the research ethics committee at Hawler Medical University/College of Medicine showing compliance with ethical standards regarding human subjects (dated: 22/9/2024).

Informed Consent Statement

Participants provided Verbal informed consents.

Conflicts of Interest

There is no conflicts of interest in this study.

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Data Availability Statement

The data used in this study are available upon request. ■

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Supplementary Tables

Table S1. Dental health services knowledge assessment

Knowledge Item*	N = 1,100
1. Knows About Dental Services	
Yes	553 (50.3%)
No	547 (49.7%)
2. Knows About Laboratory Service	
Yes	314 (28.5%)
No	239 (21.7%)
Not Applicable	547 (49.7%)
3. Knows About Sterilization Service	
Yes	323 (29.4%)
No	230 (20.9%)
Not Applicable	547 (49.7%)
4. Knows About X-Ray Service Availability	
Yes	279 (25.4%)
No	274 (24.9%)
Not Applicable	547 (49.7%)
5. Knows About Health Education Services	
Yes	207 (18.8%)
No	346 (31.5%)
Not Applicable	547 (49.7%)
6. Knows About Patient Referral Services	
Yes	241 (21.9%)
No	312 (28.4%)
Not Applicable	547 (49.7%)
7. Knows About School Health Programs	
Yes	199 (18.1%)
No	354 (32.2%)
Not Applicable	547 (49.7%)
8. Knows About Rehabilitation Services	
Yes	240 (21.8%)
No	313 (28.5%)
Not Applicable	547 (49.7%)

Data are presented as number (percentage). *N = 1100 total respondents. 'Not Applicable' refers to respondents who answered 'No' to Q1.

Table S2. Distribution of responses to attitude items

Items	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)
1. The dentist checks patients' medical record for previous illness	99 (9.0%)	159 (14%)	537 (49%)	247 (22%)	58 (5.3%)
2. The dentist shows respect for the patients	73 (6.6%)	209 (19%)	477 (43%)	235 (21%)	106 (9.6%)
3. The dentist provides adequate information regarding prescriptions side effects	71 (6.5%)	213 (19%)	475 (43%)	258 (23%)	83 (7.5%)
4. Privacy is maintained in oral health centers	86 (7.8%)	269 (24%)	452 (41%)	249 (23%)	44 (4.0%)
5. Oral health centers are clean	158 (14%)	301 (27%)	386 (35%)	197 (18%)	58 (5.3%)
6. Centers are conveniently located and easy to access	168 (15%)	291 (26%)	419 (38%)	187 (17%)	35 (3.2%)

(Continued)

Table S2. **Distribution of responses to attitude items—Continued**

Items	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)
7. Administration receives people's suggestions	138 (13%)	288 (26%)	464 (42%)	179 (16%)	31 (2.8%)
8. Oral preventive programs are good for the public	168 (15%)	282 (26%)	406 (37%)	201 (18%)	43 (3.9%)
9. Oral health service is equitable for everyone	163 (15%)	310 (28%)	418 (38%)	182 (17%)	27 (2.5%)
10. Service provides suitable medications	143 (13%)	314 (29%)	431 (39%)	177 (16%)	35 (3.2%)
11. Service is continuous	145 (13%)	318 (29%)	451 (41%)	154 (14%)	32 (2.9%)
12. Service costs are low	188 (17%)	336 (31%)	383 (35%)	146 (13%)	47 (4.3%)
13. Posters inside the building are useful	101 (9.2%)	250 (23%)	399 (36%)	240 (22%)	110 (10%)

SD, Strongly disagree; D, Disagree; N, Neutral; A, Agree; SA, Strongly agree. Data presented as number (percentage).

Table S3. **Distribution of responses to satisfaction items**

Items	SD	D	N	S	SS
1. Overall satisfaction with oral health services	92 (8.4%)	238 (22%)	583 (53%)	164 (15%)	23 (2.1%)
2. Satisfaction with dental assistants	52 (4.7%)	274 (25%)	526 (48%)	194 (18%)	54 (4.9%)
3. Satisfied with time spent with dentist	44 (4.0%)	209 (19%)	565 (51%)	193 (18%)	89 (8.1%)
4. Satisfied with treatment and care	63 (5.7%)	269 (24%)	432 (39%)	285 (26%)	51 (4.6%)
5. Satisfied with accessibility	92 (8.4%)	362 (33%)	391 (36%)	224 (20%)	31 (2.8%)
6. Satisfied with presence of dentists	75 (6.8%)	274 (25%)	353 (32%)	277 (25%)	121 (11%)
7. Dentist's humanity	51 (4.6%)	258 (23%)	402 (37%)	257 (23%)	132 (12%)
8. Satisfied with environment	95 (8.6%)	288 (26%)	444 (40%)	244 (22%)	29 (2.6%)
9. Satisfied with waiting time	166 (15%)	324 (29%)	420 (38%)	177 (16%)	13 (1.2%)
10. Satisfied with crowding	183 (17%)	341 (31%)	411 (37%)	150 (14%)	15 (1.4%)
11. Satisfied with preventive program	115 (10%)	359 (33%)	439 (40%)	165 (15%)	22 (2.0%)
12. Satisfied with admin staff	92 (8.4%)	310 (28%)	479 (44%)	187 (17%)	32 (2.9%)
13. Satisfied with communication with medical staff	88 (8.0%)	326 (30%)	443 (40%)	200 (18%)	43 (3.9%)
14. Satisfied with treatment and diagnosis costs	130 (12%)	290 (26%)	433 (39%)	168 (15%)	79 (7.2%)

SD, Strongly dissatisfied; D, Dissatisfied; N, Neutral; S, Agree; SS, Strongly Satisfied. Data presented as number (percentage).

Sensitivity Analysis

Multinomial logistic regression model fit improved progressively across hierarchical models. The Akaike Information Criterion (AIC) decreased from Model 1 (1994.29) to Model 2 (1984.23) and Model 3 (1977.77), indicating improved model fit with additional predictors. Log-likelihood values also increased across models, supporting better model performance. Likelihood ratio tests confirmed that both Model 2 ($P = 0.0012$) and Model 3 ($P = 0.0052$) significantly improved model fit compared to preceding models. Pseudo R^2 values (McFadden) increased from 0.071 in Model 1 to 0.089 in Model 3, indicating improved but moderate explanatory power.

Table S4. Multinomial logistic regression analysis of factors associated with dental service utilization

Variable	Model 1 Moderate	Model 1 Frequent	Model 2 Moderate	Model 2 Frequent	Model 3 Moderate	Model 3 Frequent
Age (years)	1.02 (1.00–1.03) <i>P</i> = 0.007	1.05 (1.03–1.06) <i>P</i> < 0.001	1.01 (1.00–1.03) <i>P</i> = 0.015	1.04 (1.03–1.06) <i>P</i> < 0.001	1.01 (1.00–1.03) <i>P</i> = 0.033	1.05 (1.03–1.06) <i>P</i> < 0.001
Female	0.97 (0.74–1.27) <i>P</i> = 0.80	0.55 (0.35–0.88) <i>P</i> = 0.013	0.98 (0.75–1.29) <i>P</i> = 0.91	0.60 (0.37–0.96) <i>P</i> = 0.034	1.00 (0.76–1.31) <i>P</i> > 0.99	0.59 (0.37–0.96) <i>P</i> = 0.033
Rural residence	1.35 (0.88–2.09) <i>P</i> = 0.17	2.57 (1.43–4.61) <i>P</i> = 0.002	1.35 (0.87–2.09) <i>P</i> = 0.18	2.54 (1.41–4.58) <i>P</i> = 0.002	1.38 (0.89–2.15) <i>P</i> = 0.15	2.39 (1.31–4.35) <i>P</i> = 0.005
Not married	1.16 (0.86–1.57) <i>P</i> = 0.33	1.81 (1.10–2.98) <i>P</i> = 0.020	1.21 (0.89–1.64) <i>P</i> = 0.23	2.22 (1.33–3.71) <i>P</i> = 0.002	1.19 (0.87–1.62) <i>P</i> = 0.28	2.40 (1.43–4.05) <i>P</i> < 0.001
No formal education	2.09 (1.42–3.08) <i>P</i> < 0.001	1.14 (0.61–2.13) <i>P</i> = 0.69	2.09 (1.42–3.08) <i>P</i> < 0.001	1.13 (0.60–2.12) <i>P</i> = 0.70	1.84 (1.24–2.74) <i>P</i> = 0.003	1.24 (0.65–2.38) <i>P</i> = 0.52
Primary education	0.76 (0.43–1.35) <i>P</i> = 0.35	0.96 (0.43–2.12) <i>P</i> = 0.91	0.76 (0.43–1.36) <i>P</i> = 0.36	0.93 (0.42–2.09) <i>P</i> = 0.86	0.68 (0.38–1.22) <i>P</i> = 0.19	0.98 (0.43–2.21) <i>P</i> = 0.96
Secondary education	0.77 (0.52–1.14) <i>P</i> = 0.19	1.15 (0.60–2.18) <i>P</i> = 0.68	0.76 (0.51–1.13) <i>P</i> = 0.18	1.03 (0.53–1.98) <i>P</i> = 0.93	0.70 (0.47–1.04) <i>P</i> = 0.080	1.14 (0.59–2.22) <i>P</i> = 0.70
Not employed	1.59 (1.10–2.29) <i>P</i> = 0.013	3.12 (1.74–5.58) <i>P</i> < 0.001	1.53 (1.06–2.23) <i>P</i> = 0.025	2.65 (1.46–4.81) <i>P</i> = 0.001	1.48 (1.02–2.15) <i>P</i> = 0.041	2.66 (1.45–4.87) <i>P</i> = 0.002
Student	1.40 (0.94–2.08) <i>P</i> = 0.10	2.38 (1.21–4.66) <i>P</i> = 0.012	1.40 (0.94–2.09) <i>P</i> = 0.10	2.54 (1.29–5.00) <i>P</i> = 0.007	1.39 (0.93–2.08) <i>P</i> = 0.11	2.55 (1.28–5.06) <i>P</i> = 0.008
Retired	0.44 (0.14–1.32) <i>P</i> = 0.14	2.38 (0.79–7.21) <i>P</i> = 0.12	0.38 (0.13–1.18) <i>P</i> = 0.094	1.53 (0.50–4.71) <i>P</i> = 0.46	0.42 (0.14–1.30) <i>P</i> = 0.13	1.32 (0.42–4.15) <i>P</i> = 0.64
Chronic disease	—	—	1.23 (0.90–1.68) <i>P</i> = 0.19	2.54 (1.53–4.21) <i>P</i> < 0.001	1.21 (0.88–1.65) <i>P</i> = 0.24	2.50 (1.51–4.15) <i>P</i> < 0.001
Oral disease	—	—	1.14 (0.86–1.52) <i>P</i> = 0.37	1.51 (0.89–2.54) <i>P</i> = 0.13	1.17 (0.87–1.56) <i>P</i> = 0.29	1.45 (0.86–2.46) <i>P</i> = 0.17
Knowledge score	—	—	—	—	0.96 (0.91–1.01) <i>P</i> = 0.080	0.99 (0.91–1.09) <i>P</i> = 0.89
Attitude score	—	—	—	—	0.98 (0.96–1.00) <i>P</i> = 0.058	1.01 (0.98–1.05) <i>P</i> = 0.60
Satisfaction score	—	—	—	—	1.01 (0.99–1.03) <i>P</i> = 0.49	1.03 (0.99–1.06) <i>P</i> = 0.12

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