Factors Associated With Dental Service Utilization Based On Andersen Model Among Adults (18 To 64 Years) In PIMS Hospital, Islamabad

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Abstract
Objectives: To determine the association and frequencies or percentages of factors influencing dental service utilization among adults based on the Andersen model.
Methodology: A cross-sectional study with convenience sampling was conducted, involving 385 adults aged 18-64 years. Data on factors based on the Andersen model, including predisposing, enabling, and need-based factors, were collected through a questionnaire. Clinically-assessed need-based factors, such as missing teeth and dental treatment need, were also included. Data were analyzed using SPSS version 26, employing frequencies, percentages, and chi-square tests.
Results: Among the study participants, 134 out of 385 individuals (34.8%) had a dental visit in the past year, and 294 out of 385 (76.4%) required dental treatments. Significant associations were observed between dental service utilization and factors such as education, residence, income, self-reported tooth/mouth pain, missing teeth, and treatment need (p < 0.05). These associations were determined while maintaining a 95% confidence interval and a margin of error of 5%.
Conclusion: The study found that factors such as education, place of residence, income levels, self-reported mouth pain, missing teeth, and the need for dental treatment significantly influenced dental service utilization among adults. The findings highlight the importance of targeted interventions and policies to improve accessibility and utilization of dental services, particularly for underserved populations.

Keywords: Adult, Andersen model, Dental services utilization.

Introduction:
The growing global recognition of oral health's importance has led to an increased focus on dental diseases, making universal dental care crucial. Understanding the utilization of dental services requires considering factors from Andersen's behavioral model, including predisposing, enabling, need-based, personal health habits, and psychosocial factors. These factors have been extensively studied and shown to influence healthcare service utilization.

Several studies have utilized Andersen's behavioral model of healthcare utilization to examine dental service usage and its influencing factors. (1,2,3)(Kim et al., 2020;Herkrath et al., 2020;Limpuangthip, N et al, 2019) Although the model has evolved over time, its fundamental components have remained largely unchanged. These components include predisposing factors (age, gender, education, and cultural norms), enabling factors (income, insurance coverage, transportation, and healthcare accessibility), and need-based factors (severity of injury or disease). Revised versions of the model have incorporated additional elements such as personal health practices (diet, exercise, alcohol consumption, tobacco use, and tooth-brushing frequency). (4) (Drachev, S.N et al, 2022)

Numerous studies conducted in different countries, including India, Brazil, Korea, and the USA, have examined factors influencing dental service utilization. (2,5) (Herkrath et al., 2020;Talukdar, R et al, 2022) A systematic review in 2021 found that the components of Andersen's behavioral model were more consistently associated with dental service utilization (DSU) in children compared to adults.(6) (Hajek, A et al, 2021)
The Andersen's behavioral model of healthcare usage was used in many studies looking at dental service utilization (DSU) and its determinants.

Following factors are included in model:
- Predisposing factors (e.g., age, gender, education, cultural norms).
- Enabling factors (e.g., money and wealth, insurance, transportation, hospital and dentist density).
- Need-based factors (e.g., level of injury or disease judged by individual or physician/dentist).
- Self-reported general health status.
- Personal health practices (such as food, exercise, alcohol, tobacco, and tooth brushing frequency).
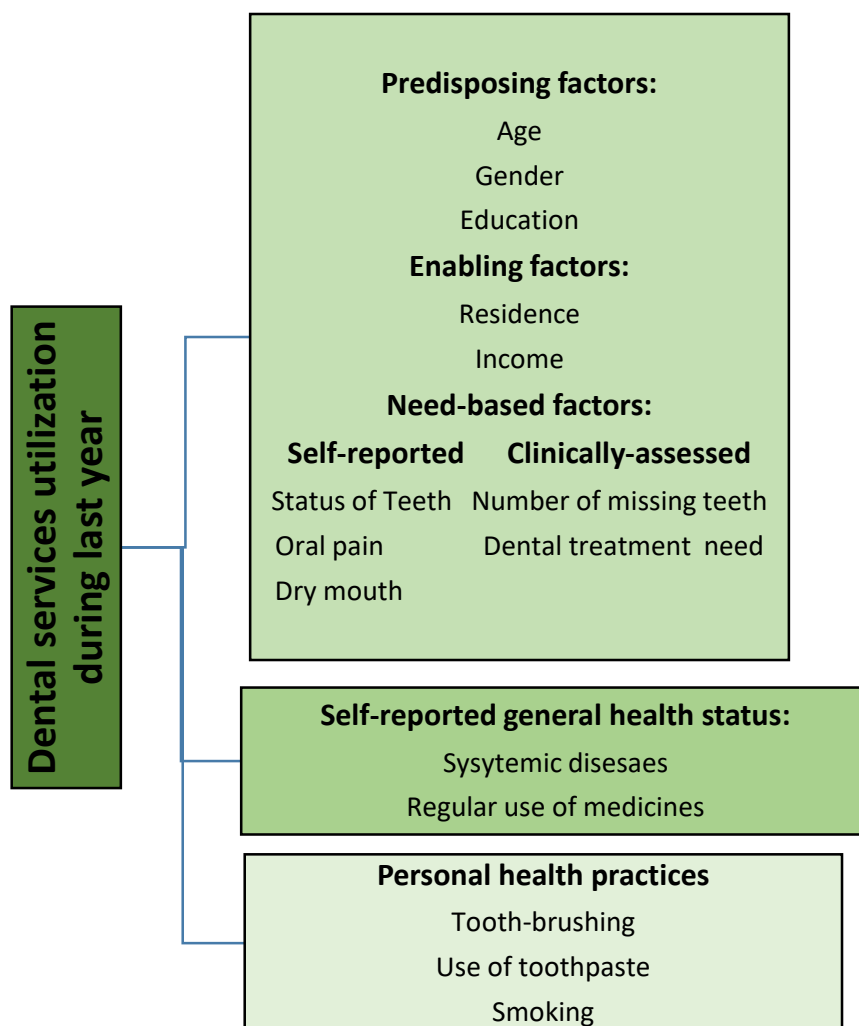

Fig.1: Conceptual framework of Andersen model

Limited research has been carried out in Pakistan. Specifically, there is a lack of studies focusing on dental service utilization among adults and the elderly population in Pakistan. Most of the existing research in Pakistan has predominantly concentrated on women and their utilization of dental services.(7,8,9) (Sattar, F.A. and Khan, A.H., 2020, Mubeen, N & Nisar, N., 2015, Bahramian, H et al, 2018) Thus, there is a significant gap in understanding the patterns and determinants of dental service utilization among adults and the elderly in Pakistan. Bridging this gap through comprehensive studies would provide valuable insights for improving dental healthcare access and utilization among these population groups in the country.

METHODOLOGY:
This cross-sectional study was carried out at Pakistan Institute of Medical Sciences (PIMS) hospital in Islamabad, Pakistan. The sample size for this study was determined using the World Health Organization (WHO) sample size calculator (z^2pq/e2), assuming a prevalence rate of 50%. As a result, the final sample size was determined to be three hundred and eighty five participants.
Convenience sampling method was employed while carrying out epidemiological survey Inclusion criteria of this study was patients of age (18 to 64 years), who came in OPD (outpatient department) of PIMS Hospital, Islamabad. Individuals who were not willing to participate in the study and critically ill patients were excluded. A structured questionnaire based on the Andersen model was used to assess factors associated with the utilization of dental services in

this study. The questionnaire included sections on predisposing factors (demographics), enabling factors (income, residence), and need factors (perceived health status, severity of illness). It also addressed self-reported general health, personal health practices, and specific oral health needs. The questionnaire underwent a meticulous translation process into native language Urdu using forward-backward technique to ensure effective communication with the Urdu-speaking participants. Validation of the questionnaire was conducted, obtaining permission from the original author[5], and calculating the Cronbach's alpha coefficient for reliability which was 0.764. Overall, the questionnaire served as a comprehensive tool to gather data on various factors influencing dental service utilization among the study participants.

In addition to the questionnaire, a physical examination component was integrated to assess the need-based factors associated with dental services utilization. This involved utilizing mirror, probe and artificial light. The number of missing teeth in participants' mouths was carefully observed and recorded. To assess gingival bleeding, plaque and calculus on tooth surfaces, CPITN index was used.

Data for the study was collected from the Outpatient Department (OPD) of PIMS hospital, following a careful and ethical approach. Verbal consent was obtained from willing participants, who were assured of the voluntary nature of their participation. A structured questionnaire was used to gather information on demographic details, oral health practices, previous dental visits, and the need for dental treatments. Additionally, a physical examination was conducted using dental instruments and visual inspection to assess participants' oral health conditions, including missing teeth, gum diseases. Privacy and confidentiality were maintained throughout the process, with data recorded securely. Ethical guidelines were strictly followed, and any concerns raised by participants were addressed promptly. This meticulous approach ensures the reliability and validity of the data collected, supporting the research objectives of the study.

The study assessed the dependent variable of dental service utilization (DSU) over the past year, categorized as "yes" or "no" based on participants' reported time of their last dental visit. The independent variables examined included predisposing factors (age groups, gender, education level), enabling factors (residence, income), and need-based factors (teeth status, pain/discomfort, dry mouth, missing teeth, dental treatment needs). Additional factors such as general health status, systemic diseases, medication use, oral health practices, and smoking were also considered.

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 26. Frequencies and percentages were computed for each variable to examine their distributions. The associations between the dependent and independent variables were assessed using the chi-square test, keeping confidence of interval 95% and margin of error 5%, enabling the identification of potential relationships between the variables considering significant p-value <0.05. Visual aids in the form of graphs and charts were created to enhance understanding and facilitate data comprehension.

This study was reviewed and approved by the ethical review board of Armed Forces Post Graduate Medical Institute. Research was done after getting permission from administration of PIMS hospital. After explaining the study's goals to each participant, their informed consent was obtained. At the start of each session, all participants got adequate descriptions of the study's goals and verbal consent was taken.

Results:
Socio-demographic Characteristics:
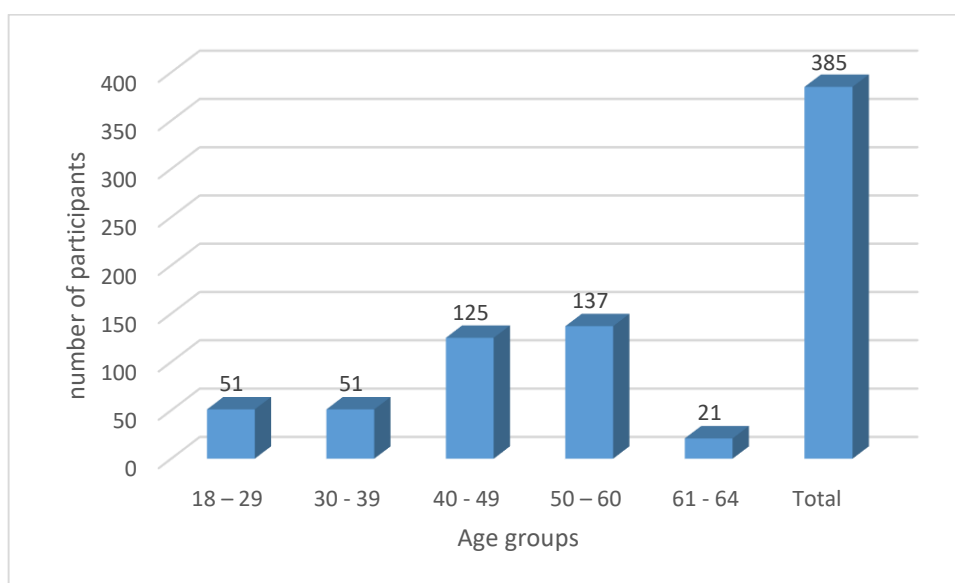A total of 385 participants took part in the research study, and their age distribution was as shown in fig.1.

Fig.2: Age distribution of respondents.

In terms of gender distribution, out of the 385 participants, 178 were male, while 207 were female.

Table: 1 Gender distribution of respondents.

Sr. No.	Gender	Percentages
1	Male	46.3%
2	Female	53.7%
3	Total	100%

The educational level of the respondents was 65.9% had less than a university education, while 34.1% had more than a university education.

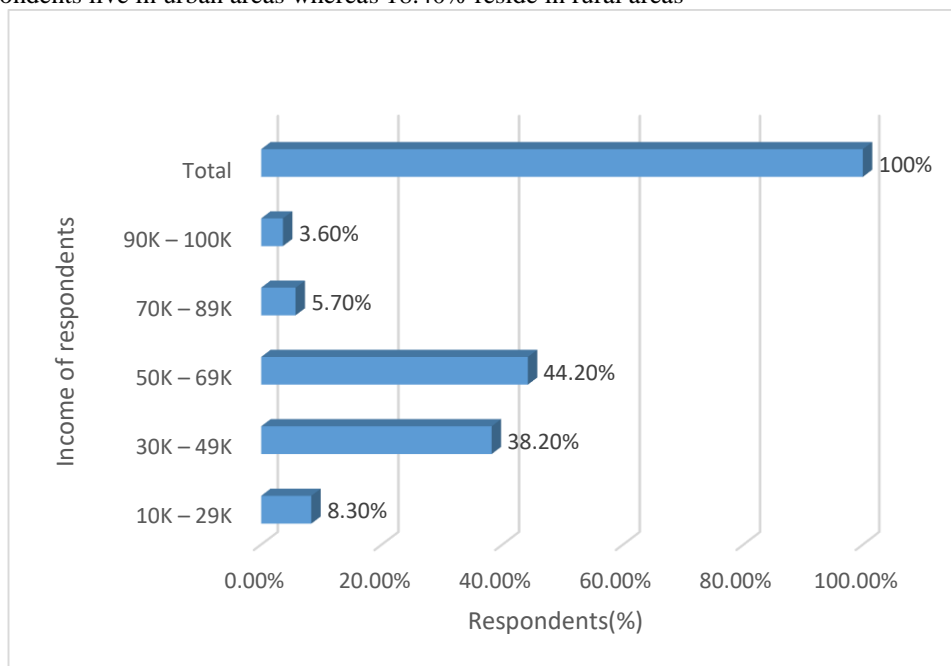81.50% of respondents live in urban areas whereas 18.40% reside in rural areas

Fig.3: Income of study participants.

Predisposing factors:

In this study, the Andersen model was utilized to examine the association between predisposing factors, such as age, gender, and education, and the utilization of dental services. The association between gender, age, and dental visits was found to be statistically insignificant, as indicated in the accompanying table 2.

Table 2: Age and Gender distribution and its association with dental services utilization.

	Dental visits in last year		
Independent variables	**Yes (%)**	**No (%)**	**P – value**
Age groups			
18 – 29	25(49%)	26(51%)	
30 - 39	19(37.3%)	32(62.7%)	
40 - 49	46(36.8%)	79(63.2%)	0.07
50 – 60	39(28.5%)	98(71.5%)	
61 - 64	5(23.8%)	16(76.2%)	
	134(34.8%)	251(65.2%)	
Total	385(100%)		
Gender			
Male	66(37.1%)	112(62.9%)	0.385
Female	68(32.9%)	139(67%)	
Total	134(34.8%)	251(65.2%)	
	385(100%)		

The majority of participants (65.9%) had education below the university level, while 34.1% had education beyond the university level. There was a statistically significant association between educational attainment and dental visits (p<0.01) Figure.1.
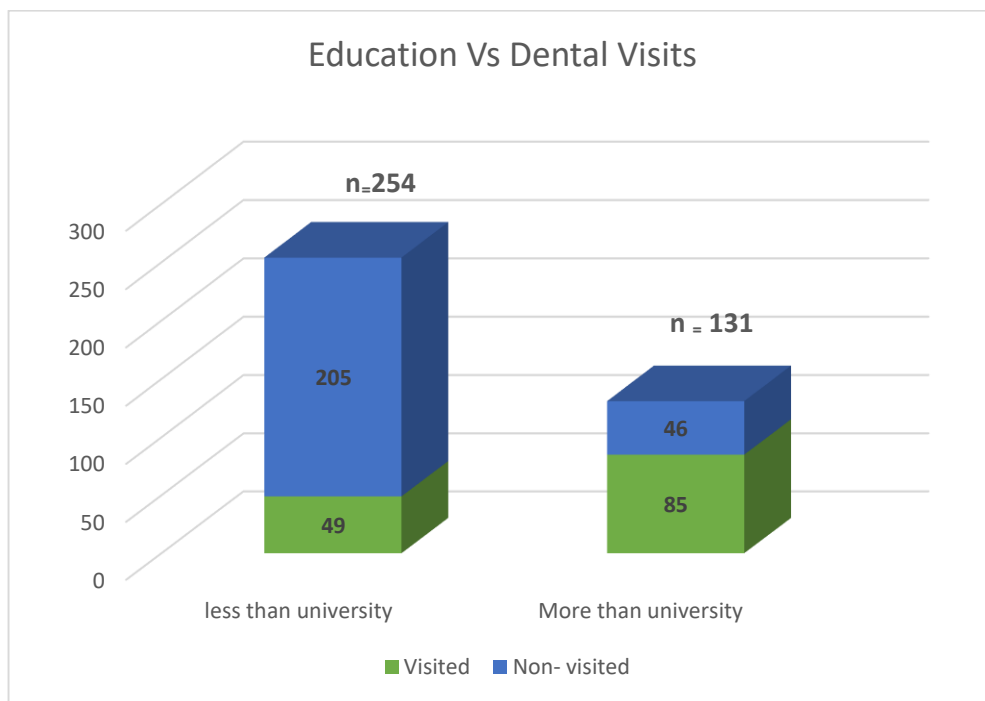
Fig 4: Educational level and its association with dental services utilization.

Enabling factors:

The majority of participants resided in urban areas, while a smaller number came from rural areas, as depicted in the accompanying figure 2. Notably, there was a significant association between residing in these different areas and dental visits, as evidenced by a p-value of 0.033 residing in these different areas and dental visits, as evidenced by a p-value of 0.033
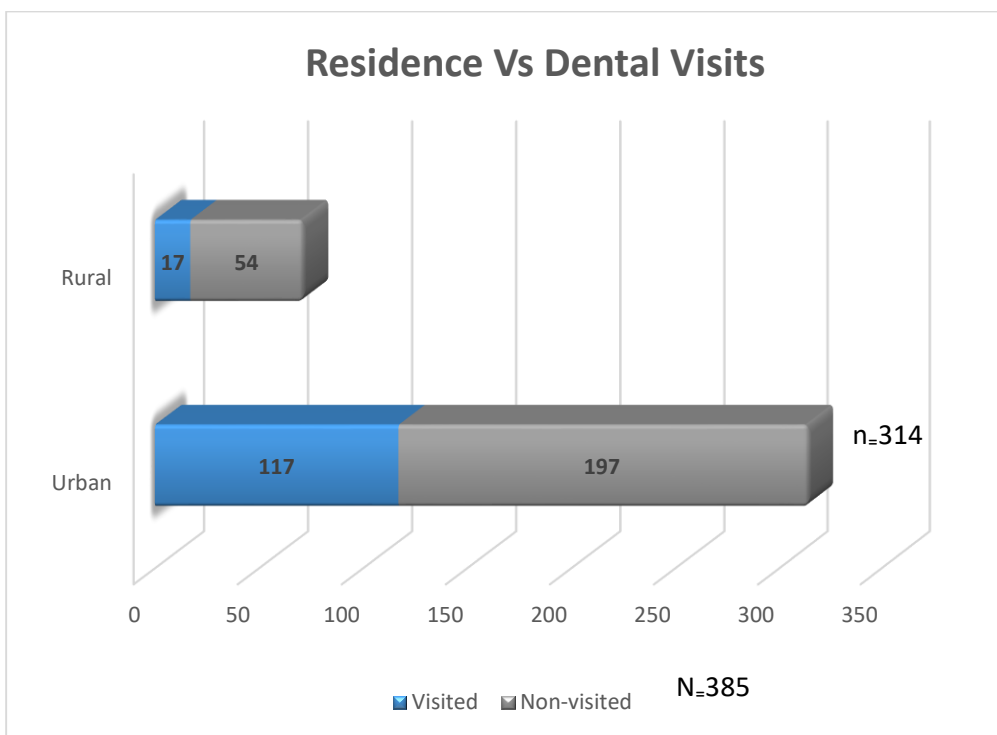

Fig 5: Distribution of resident areas and its association with dental visits.

The figure 3 illustrates the distribution of income among the participants, and an analysis revealed a significant association between income and dental visits, indicated by a p-value of less than 0.001.
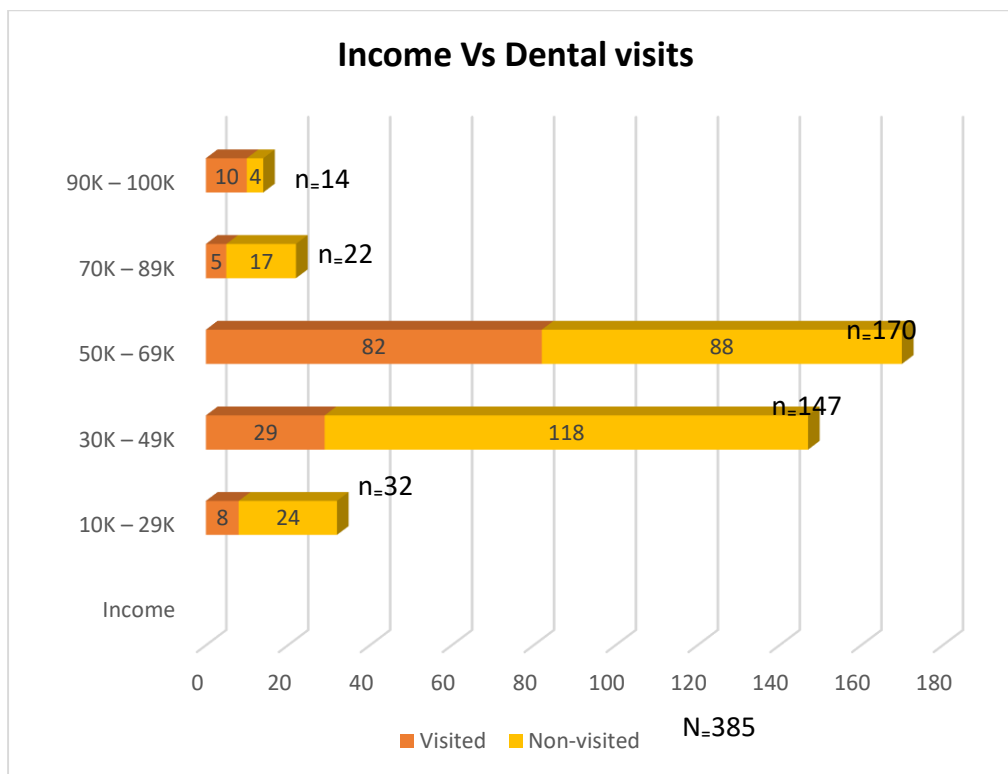
Fig 6: Income of participants and its association with dental services utilization.

Need-based factors:

Table 3: Factors Influencing Dental Service Utilization Based on Needs

Independent variables	n (%)	Dental visits in last year		P – value
		Yes (%)	No (%)	
Self-reported status of teeth				
Good	101(26.2%)	34(33.7%)	67(66.3%)	0.93
Average	193(50.1%)	67(34.7%)	126(65.3%)	
Poor	91(23.6%)	33(36.3%)	58(63.7%)	
Experienced pain/Discomfort in teeth				
Yes	197(51.1%)	103(52.3%)	94(47.7%)	< 0.01
No/ Don't know	188(48.8%)	31(16.5%)	157(83.5%)	
Self-reported Dry mouth				
Yes	38(9.8%)	12(31.6%)	26(68.4%)	0.66
No	347(90.1%)	122(35.2%)	225(64.8%)	
Number of missing teeth				
0 – 3	247(64.1%)	85(34.4%)	162(65.6%)	0.010
4 - 6	138(35.8%)	66(47.8%)	72(52.2%)	
Total		385(100%)		

The self-reported teeth status was average and not significantly associated with dental service utilization. However, participants who experienced pain or discomfort in their teeth or mouth were more likely to seek dental care. Dry mouth did not show a significant association with dental service utilization. A higher number of missing teeth was linked to increased dental visits, with individuals having 4-6 missing teeth being more inclined to visit the dentist. These findings highlight the influence of dental pain/discomfort and the number of missing teeth on dental service utilization. Addressing these factors can help promote better utilization of dental care services.

Dental treatment needs:

Among the study participants, 34.8% had a dental visit in the past year, while 76.4% required dental treatments. The majority of participants needed dental treatment. There was a significant association between the need for dental treatment and having had a dental visit within the past year (p-value 0.004). Figure 4 visually represents the distribution of respondents based on their need for dental treatment and dental service utilization.
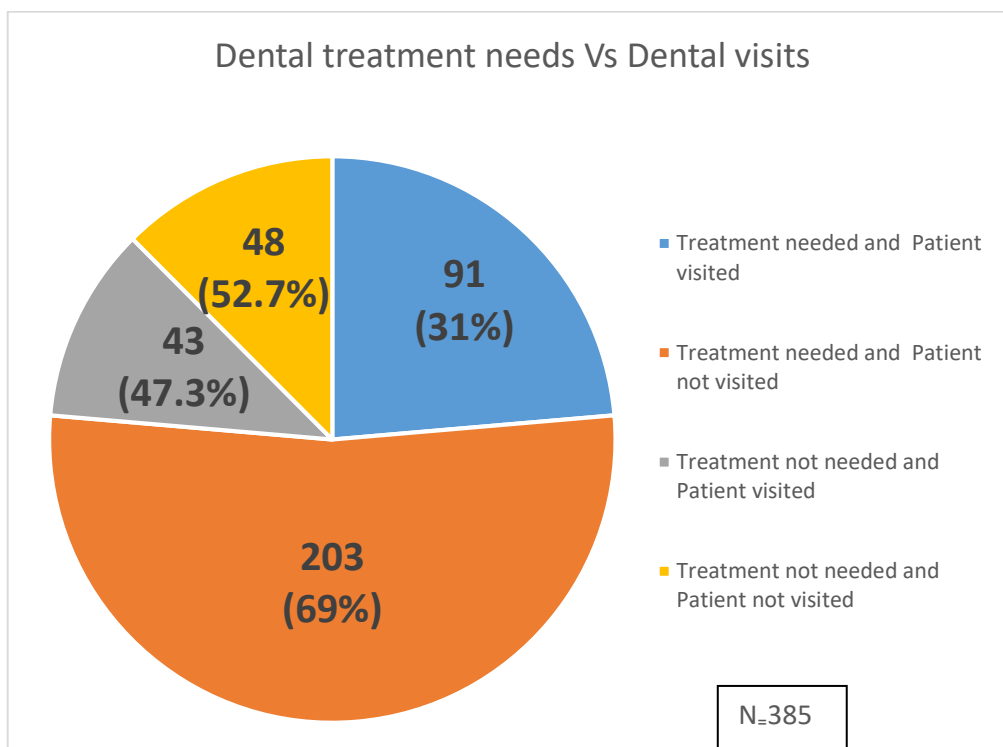

Fig. 7: Dental treatment needs of respondents versus dental visits.

Personal health practices and self-reported general health status:

Table 4: Personal health practices and self-reported general health status in association with dental service utilization

Independent variables	n (%)	Dental visits in last year		P – value
		Yes (%)	No (%)	
Frequency of tooth brushing				
Less than twice a day	281(72.9%)	94(33.5%)	187(66.5%)	
Twice a day	104(27.0%)	40(38.5%)	64(61.5%)	0.36
Use of toothpaste				
Yes	306(79.4%)	122(39.9%)	184(60.1%)	0.608
No	79(20.5%)	29(36.7%)	50(63.3%)	
Cigarette smoking				
Yes	154(40%)	50(32.5%)	104(67.5%)	0.432
No	231(60%)	84(36.4%)	147(63.6%)	
Self-reported systemic diseases				
Yes	118(30.6%)	45(38%)	73(61.9%)	0.362
No	267(69.3%)	89(33.3%)	178(66.7%)	
Self-reported regular medicine				
Yes	151(39.2%)	55(36.4%)	96(63.6%)	0.592
No	234(60.7%)	79(33.8%)	155(66.2%)	
Total		385(100%)		

In the study sample, 27% of participants reported brushing their teeth twice a day or more frequently, while 72.9% brushed their teeth less than twice a day. The majority of participants (79.4%) reported using toothpaste as their primary method for cleaning their teeth, while 20.5% used alternative methods. Among the participants, 60% reported not smoking cigarettes, indicating a majority of non-smokers. Approximately 30.6% of participants reported having systemic diseases, and 39.2% reported taking medications regularly. However, none of these personal health practices, self-reported systemic diseases, or regular medication usage showed a significant association with dental service utilization.
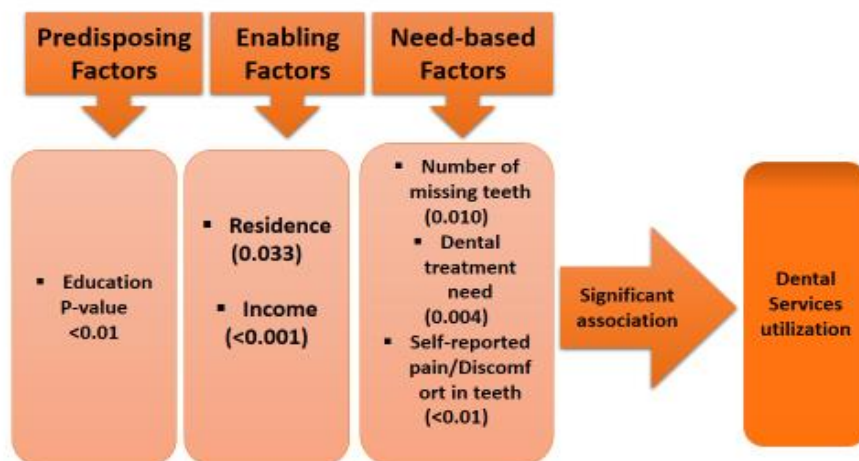
Outcome:

Fig 8: Framework shows factors affecting dental services utilization.

Discussion:
This cross-sectional study aimed to find association between dependent and independent variables of dental services utilization based on Andersen model among 385 participants at PIMS hospital in Islamabad. The association between gender and dental service utilization showed no significant association (p=0.385). Similar findings have been reported in studies conducted in India and Nigeria. (10,11)(Bommireddy et al., 2016; Adeniyi & Oyapero, 2020)
This study examined the association between age, education, and dental service utilization among 385 participants aged 18 to 64 years. The results showed no significant association between age and dental service utilization (p=0.07), consistent with studies from Korea and Saudi Arabia.(1,12)(Kim et al., 2020; Sahab et al., 2022) However, there is mixed evidence on the role of age in dental service utilization according to a systematic review.(6)(Hajek et al., 2021) Education level was found to be a significant predictor of dental service utilization (p<0.01), with higher-educated individuals more likely to utilize dental services. This finding aligns with studies conducted in Brazil, Pakistan, and India.(2,5,13)(Herkrath et al., 2020; Aliuddin et al., 2021; Talukdar et al., 2021) The systematic review also supports the association between education level and dental service utilization, highlighting the role of education in oral health awareness and behavior.(6)(Hajek et al., 2021) These findings emphasize the importance of targeting populations with lower education levels to improve oral health literacy and promote regular dental care through educational campaigns and outreach programs.

This study investigated the association between various factors and dental service utilization among adults. The findings revealed that residence (urban or rural) was significantly associated with dental visits, with individuals in urban areas more likely to utilize dental services. This aligns with studies conducted in Canada, Brazil, and China.(2,14,15)(Gaber et al., 2018; Herkrath et al., 2020; Qu et al., 2020) Income was also found to be a significant predictor, with higher-income individuals more likely to utilize dental services, consistent with studies from America, China, India, and Brazil.(5,16,17) (Chen et al., 2019; Rebelo Vieira et al., 2019; Talukdar et al., 2021) The presence of pain and discomfort in the teeth or mouth over the past year was associated with higher dental service utilization, consistent with studies conducted in Korea, Brazil, and Lithuania.(1,18)(Fonseca et al., 2017; Kim et al., 2020) The number of missing teeth and the need for dental treatment were also correlated with dental visits, supported by studies in Lithuania and other countries. (4,19) (Christensen et al., 2016; Drachev et al., 2022) However, no significant correlation was found between dental service utilization and personal health practices, such as systemic diseases and regular medication intake. These findings emphasize the importance of addressing disparities in dental care access and promoting oral health awareness and treatment for individuals in different geographic locations, income groups, and dental conditions.

Conclusion:

This study sheds light on multiple factors that play a crucial role in the utilization of dental services among adults. Out of the 385 participants, a considerable majority of adults exhibited a need for dental treatments, yet only a little more than one-third of them sought dental care within the past year. Notably, education, residence, income, self-reported pain in the mouth over the last year, missing teeth, and the need for dental treatment emerged as key influencers of dental service utilization.

Recommendations:

To improve dental service utilization among adults, it is important to increase awareness through public campaigns, improve access by expanding dental clinics, enhance affordability through subsidies or insurance coverage, encourage regular check-ups, tailor services to specific populations, and conduct research for evidence-based strategies. These efforts can lead to better oral health outcomes and increased utilization of dental services.

Limitations: The study had limitations including potential self-reporting biases, as all data collected relied on participants' self-reports. Convenience sampling was used, introducing selection bias and limiting generalizability. The dental examination was not conducted in proper dental setups, potentially impacting the accuracy of dental assessments. The study's location outside the community may have introduced bias, limiting the representation of diverse perspectives and experiences.

Conflict of interest:

No conflict of interest declared by authors.

References

1. Kim HN, Han SJ, Jun EJ, Kim JB. Factors related to oral healthcare service utilization among Korean adults aged 25–79 years. International Journal of Environmental Research and Public Health. 2020 Sep;17(17):6032.
2. Herkrath FJ, Vettore MV, Werneck GL. Utilisation of dental services by Brazilian adults in rural and urban areas: a multi-group structural equation analysis using the Andersen behavioural model. BMC public health. 2020 Dec;20:1-3..
3. Limpuangthip N, Purnaveja S, Somkotra T. Predisposing and enabling factors associated with public denture service utilization among older Thai people: a cross-sectional population-based study. BMC Oral Health. 2019 Dec;19:1-8. Andersen, R.M., 2008. National health surveys and the behavioral model of health services use. Medical care, pp.647-653.
4. Drachev SN, Puriene A, Aleksejuniene J, Stankeviciene I, Stangvaltaite-Mouhat L. Prevalence of and factors associated with dental service utilization among early elderly in Lithuania. BMC health services research. 2022 Dec;22(1):1-9.
5. Talukdar R, Barman D, Thakkar V, Kanungo S. Utilization of dental care services among adult Indian population: A meta-analysis of evidence from 2011–2022. Health Promotion Perspectives. 2022;12(4):325.
6. Hajek A, Kretzler B, Koenig HH. Factors associated with dental service use based on the Andersen model: a systematic review. International journal of environmental research and public health. 2021 Mar 3;18(5):2491..
7. Sattar FA, Khan AH. Prenatal Oral Health Care and Dental Service Utilization by Pregnant Women: A Survey in Four Maternity Centers of Gulshan Town, District East, Karachi. Journal of the Pakistan Dental Association. 2020 Apr 1;29(2).
8. Mubeen N, Nisar N. Pattern of dental health care utilization among mothers in Karachi, Pakistan. International Journal of Dental Clinics. 2015 Jul 1;7(3):10-4.
9. Bahramian H, Mohebbi SZ, Khami MR, Quinonez RB. Qualitative exploration of barriers and facilitators of dental service utilization of pregnant women: A triangulation approach. BMC pregnancy and childbirth. 2018 Dec;18(1):1-1.
10. Bommireddy VS, Koka KM, Pachava S, Sanikommu S, Ravoori S, Chandu VC. Dental service utilization: Patterns and barriers among rural elderly in Guntur district, Andhra Pradesh. Journal of clinical and diagnostic research: JCDR. 2016 Mar;10(3):ZC43.
11. Adeniyi AA, Oyapero A. Predisposing, enabling and need factors influencing dental service utilization among a sample of adult Nigerians. Population Medicine. 2020 Dec 23;2(December):1-9.
12. Sahab DA, Bamashmous MS, Ranauta A, Muirhead V. Socioeconomic inequalities in the utilization of dental services among adults in Saudi Arabia. BMC Oral Health. 2022 Apr 21;22(1):135.
13. Aliuddin AM, Ali JZ, Sheikh A, Rashid S. Obstacles to utilization of dental services in Karachi, Pakistan. Pakistan Armed Forces Medical Journal. 2021 Apr 28;71(2):454-59.
14. Gaber A, Galarneau C, Feine JS, Emami E. Rural-urban disparity in oral health-related quality of life. Community dentistry and oral epidemiology. 2018 Apr;46(2):132-42.
15. Qu X, Qi X, Wu B. Disparities in dental service utilization among adults in Chinese megacities: Do health insurance and city of residence matter?. International journal of environmental research and public health. 2020 Sep;17(18):6851.

16. Chen M, Wright CD, Tokede O, Yansane A, Montasem A, Kalenderian E, Beaty TH, Feingold E, Shaffer JR, Crout RJ, Neiswanger K. Predictors of dental care utilization in north-central Appalachia in the USA. Community dentistry and oral epidemiology. 2019 Aug;47(4):283-90.

17. Rebelo Vieira JM, Rebelo MA, Martins NM, Gomes JF, Vettore MV. Contextual and individual determinants of non-utilization of dental services among Brazilian adults. Journal of public health dentistry. 2019 Jan;79(1):60-70.

18. Fonseca EP, Fonseca SG, Meneghim MD. Factors associated with the use of dental care by elderly residents of the state of São Paulo, Brazil. Revista Brasileira de Geriatria e Gerontologia. 2017 Nov;20:785-96.

19. Christensen LB, Rosing K, Lempert SM, Hede B. Patterns of dental services and factors that influence dental services among 64–65-year-old regular users of dental care in D enmark. Gerodontology. 2016 Mar;33(1):79-88.