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Authors
Dr. Ambika Prasad Pandey[1*]
Professor and Head of the Department of Sociology, School of Liberal Education, Galgotias University Greater Noida, U.P., India, E-mail: ambika.prasad@galgotiasuniversity.edu.in, ORCID ID: 0000-0002-7219-8787

Dr. Prakash Chandra Dilare [2]
Department of Sociology, School of Humanities and Social Sciences, Gautam Buddha University, Greater Noida,U.P., India, E-mail: prakash.csss.jnu@gmail.com, 0000-0002-9931-6165

Dr. Manushi[3]
Senior Research Assistant, Centre for Media & Communication Research, Indian Institute of Mass Communication (Deemed to be University), New Delhi 110067, E-mail: manushi123@gmail.com, ORCID ID: 0009-0007-2206-3458

Dr. Rahul Kapoor[4],
Assistant Professor, Department of Social Work, SoHSS, Gautam Buddha University, Greater Noida,U.P., India, E-mail: rahul.kapoor@gbu.ac.in, ORCID ID:0000-0002-2766-9965

Dr. Hemalatha K J[5]
Assistant professor, Department of Commerce and Management, Specialization: Accounts and Taxation, Bengaluru City university, Email ID: hemalth85@gmail.com, ORCID ID: 0000-0003-4463-1114

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Evidence-Based Oral Health Education and Promotion: Behavioral Interventions, Community Outreach, and Policy Strategies in Restorative Dental Care

Abstract
Oral health remains a significant public health issue and there is a shift towards preventive and restorative dentistry. This study reviewed the oral health status of adults in the United States and the resulting disparities over a seven-year time period based on information from the National Oral Health Surveillance System. The 31,542 adult oral health records from the Behavioral Risk Factor Surveillance System data collection were used in the secondary analysis of quantitative, descriptive and secondary data. The study looked at trends in adults' dental visits (aged 18 years and over) and trends in tooth loss indicators (aged 65 years or over). Comparisons were also made between the different groups based on the factors of income, education, race, gender and age. There were no significant differences between 2012-2020, older adults who were without teeth remained a burden on oral health. Dental visit prevalence was shown to be low and tooth loss prevalence high in low-income and less-educated populations. Prevalence of dental visits was significantly different between low income and less educated groups, as was dental loss. Disparities in oral health outcomes were also observed based on race. These findings indicate that besides the improved oral health, its education, behavior change and community outreach and supportive policies on the community, will all be positive contributors that will help to cut down on the number of restorative dental services required. The prevention can be improved and dental services better accessed, which could help maintain oral health equity and quality of life over the long-term.

1. Introduction

A vital component of general health and wellbeing is oral health, impacting nutrition, communication, appearance, quality of life and social interaction. Although preventive and restorative dental care has advanced significantly, oral diseases are still one of the more prevalent chronic diseases of the world. Millions of adults and older adults still suffer from dental caries and periodontal disease and experience tooth loss, especially among those from socioeconomically disadvantaged populations [1]. The World Health Organization estimates that oral diseases plague almost 3.5 billion people worldwide, and that the inequities in access to preventive and restorative oral health services continue to be a significant public health challenge [2]. Oral diseases can cause pain, infection, chewing difficulties, social embarrassment, poorer quality of life and higher health care expenses. Nowadays, the significance of dental health extends beyond the field of therapeutic care and entered the arena of public health, where preventive, educational, behavioral, and policy-based strategies are needed.

Restorative dental care is an essential part of the management of oral disease following damage, but many restorative conditions are preventable when good oral health promotion and education is achieved. Preventive oral health measures such as regular dental care, oral hygiene education, fluoride, dietary counselling, and behaviour change strategies can have a major impact on the

burden of oral diseases [3]. However, there are still differences in oral health outcomes among various age groups, races, income levels, education levels, and geographic areas. Social determinants of oral health, including poverty, education, access to health care and public health policy, were found to be well correlated with oral health inequalities [4]. In the same way, Guarnizo-Herreño et al. noted that individual behaviours are not the only factors affecting oral health outcomes, but that political, economic and social factors also play a role [5].

Loss of teeth continues to be one of the most significant measures of total Oral disease burden, especially in elderly people. The loss of a single tooth or several teeth can have an impact on nutrition, social interactions, self-esteem and speech abilities. Even though there has been progress in preventive dental care for older people, tooth loss remains an issue for a large percentage of older adults in the United States [6]. In vulnerable older adults, oral health issues can also be harmful for their body image, self-assurance and social engagement [7]. In addition, in recent years epidemiological studies have shown that dental caries and periodontal disease and tooth loss are also important health problems in older people [8]. he continued occurrence of these oral health issues indicates a lack of preventative, educational and early intervention public health strategies.

There has been growing understanding of the cause of oral diseases which has led to a focus on the significance of preventive oral health care. Spatafora et al. have detailed the changing nature of the oral microbiome in the development of dental caries and the interplay between the biological and the behavioral are highlighted as it progresses [9]. The significance of offering evidence-based oral health education is supported by this data and behavior modification approaches to reduce the risk for disease before it needs to be restored. To solve this problem concerning the oral disease at global level, the World Health Organization, published the Global Strategy and Action Plan on Oral Health 2023-2030 in which it has been mentioned that universal oral healthcare coverage and prevention care are priorities to integrate oral healthcare in public health systems [10].

Despite best intentions, there are still a number of populations where inequities in the use of restorative dental care and/or preventive service exist. Compared to adults with higher socio-economic status, lower-level adults may be less likely to get dental care, less likely to undergo preventive care visits, and more likely to be missing teeth. The inequalities show the need for interventions with evidence and behavioral education, community outreach, and public health policies that support. Anyikwa and Ogwo highlighted the need for public health policy reform to achieve better oral health outcomes and reduce disparities in access to oral health care [11]. Similarly, Carrasco-Labra et al. indicated that dental guidelines based on evidence are increasingly relevant to maximize clinical decisions and promote equity in delivering oral health care [12].

The current research is going to examine the changes in dental visits and tooth loss among adults in the United States over 2012-2020 based on the data provided by the National Oral Health Surveillance System (NOHSS). The study considers the inequities in oral health by demographic and socioeconomic status and the contribution of behavioral interventions, community based outreach and policy interventions in supporting restorative dental care and promoting oral health. Overall, the purpose of the research is to demonstrate the trend of adult dental use, investigate the indicators of tooth loss in older adults, address the oral health outcomes and demographic, and socioeconomic group, and discuss the evidence-based intervention to improve the benefits of restorative dentistry in adults.

2. Methods

2.1 Study Design

This study employed a descriptive, quantitative, and secondary data analysis design with adult oral health surveillance data from the public domain. The design was suitable for the study because it was designed to look at how oral health is going in adults, without collecting any new clinical or experimental data. The method enabled the trends in using dental services and in the experience of tooth loss among different demographic and socioeconomic groups to be described. The design also related to the overall theme of the research article, which was the connection between adult outcomes of oral health and evidence-based oral health education, behavioral interventions, community outreach, and policy strategies in restorative dental care.

2.2 Data Source

The information used for this study consists of 31,542 records of the NOHSS adult indicators. It contains data on adult oral health outcomes by year, state/location, indicator type, response category, prevalence value, confidence intervals, sample size, and breakout category [13]. The data set was employed as the primary source of data to assess visits to adults for dental care and tooth loss indicators related to oral health promotion and oral-restorative care.\

2.3 Study Period

The study covered the years 2012, 2014, 2016, 2018, and 2020, as reported in the dataset. The years were followed up in regard to indicators of adult oral health with time. Trends could be compared between dental visits among adults (aged 18 years and above) and tooth loss among adults (aged 65 years and above) over time studied.

2.4 Study Population

The study population included adults in the United States who were represented in the National Oral Health Surveillance System (NHSS) adult indicators dataset. Dentist visit indicator included all adults (18 years and older); tooth loss indicators included adults 65 years and older. They were consistent with the age groups indicators reported in the dataset, and enabled the study to analyze preventive dental care behavior and oral health outcomes of restorative dental care needs.

2.5 Key Variables

Independent variables in this study consisted of year, state or location, age group, gender, race, income, and education. The variables were used to explore over-time, geographic, and population subgroup differences in oral health results. The three major outcome measures known as adult oral health indicators that were obtained in the dataset were used as the dependent variables. These were adults (18 years and older) who had visited a dentist or dental clinic within the last year, adults aged 65 years or older who had lost all their natural teeth as a result of tooth decay or gum disease, and adults aged 65 years old or older who had lost six or more teeth as a result of tooth decay or gum disease. These dependent variables were all directly related to preventive dental behavior, tooth loss burden, and the need for restorative dental care.

2.6 Data Measures

Crude prevalence percentage, confidence intervals, sample size, response category and breakout category were the main measures to be used in this study. Each oral health outcome was crudely described in terms of prevalence percentage as the proportion of adults who reported the outcome. The use of confidence intervals to denote the reliability of prevalence estimates and sample size to provide information of the number of respondents that each record was representing were applied. The results were distinguished by "Yes" and "No" response and broken out by demographic and socioeconomic groups using response category and breakout category respectively.

2.7 Data Analysis Plan

Descriptive and comparative analysis of adult oral health indicators was the focus of the data analysis. Values of prevalence for dental visits and tooth loss indicators were summarized using descriptive statistics. Trend analysis was used to compare changes across the years 2012, 2014, 2016, 2018, and 2020. Comparisons also were made by state or location and by demographic breakout groups, such as income, race, education, gender and age. The purpose of the analysis was to identify disparities in oral health based on the prevalence of dental visits or tooth loss. Results were analyzed in the context of behavioral interventions, outreach efforts, and policy strategies that could enhance the delivery of oral health education, prevention and restorative dental care.

2.8 Ethical Considerations

Secondary, publicly available and anonymized surveillance data were used. There was no information on the individual patients or personal identifiers in the dataset. Hence, no patient consent was necessary. The appropriateness of the use of the data set for a public health research project seeking to enhance the provision of dental health education, promotion and restorative care.

3. Results

3.1 Description of Dataset

The National Oral Health Surveillance System (NOHSS) adult indicators were included in the dataset with 31,542 records and 23 variables. All data consisted of Adult data and the data source was identified as BRFSS. The dataset covered five survey years: 2012, 2014, 2016, 2018, and 2020. It contained information for 55 sites, which were all U.S. states, national level records, and selected territories. Three measures of adult oral health were examined: Dental visits by adults (18 years and older), Six or more missing teeth in adults (65 years and older), and Complete tooth loss in adults (65 years and older). Table 1 gives overall description of the data set such as no of records, number of variables, study years, locations, data source, category and number of indicators.

Table 1. Description of Dataset

Dataset Characteristic	Result
Total records	31,542
Total variables	23
Years included	2012, 2014, 2016, 2018, 2020
Number of locations	55
Data source	BRFSS
Category	Adult
Indicators included	3

3.2 Trends in Dental Visits

There was little change over time in the mean crude prevalence of adults 18 years and older who visited a dentist or dental clinic within the last 12 months. The prevalence was 63.13% in 2012, decreased slightly to 62.15% in 2014, increased again to 63.13% in 2016, and reached the highest value of 63.74% in 2018. In 2020, the prevalence declined to 62.41%. The findings also indicated that there was little variation in the prevalence of dental visits for adults between 2012 and 2020 and there was no measurable long-term trend in this prevalence over the study period. Table 2 shows the change in the mean crude prevalence of dental visits for adults aged 18 years and over from 2012 to 2020.

Table 2. Trends in Dental Visits Among Adults Aged 18+

Year	Mean Crude Prevalence (%)
2012	63.13
2014	62.15
2016	63.13
2018	63.74
2020	62.41

Figure 1 shows the trend in dental visits among adults aged 18 years and older across the study period. This figure present a line graph showing the mean crude prevalence of dental visits from 2012 to 2020.

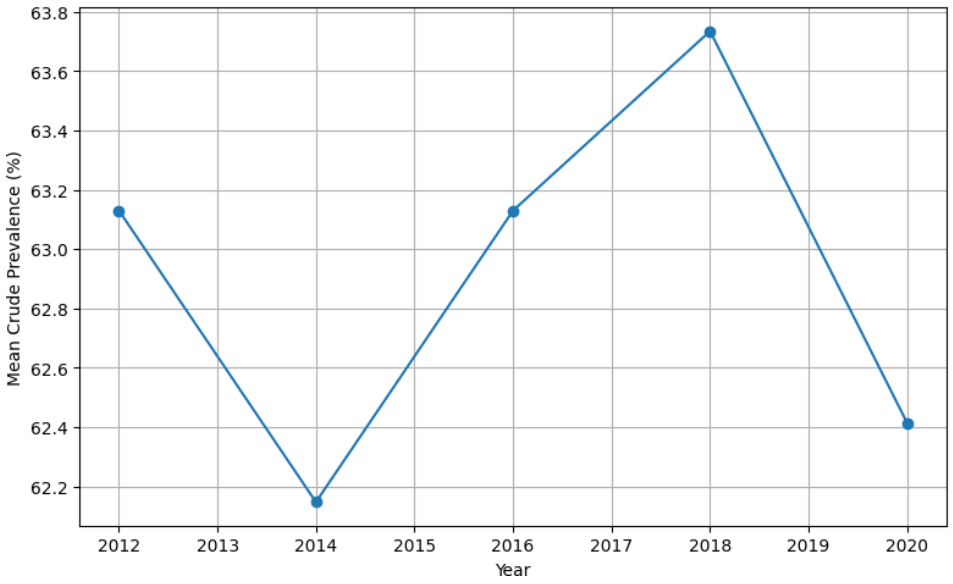

Figure 1. Trend in Dental Visits Among Adults Aged 18+

3.3 Tooth Loss Among Older Adults

Adults 65 years of age and older were found to have lost teeth. Results indicated that complete tooth loss and loss of 6 or more teeth continued to be significant oral health issues among older adult population. Complete tooth loss was defined as adults with no natural teeth remaining from tooth decay or gum disease, and adults with 6 or more teeth missing from tooth decay or gum disease was defined as the second tooth loss indicator. These indicators measure a cumulative disease burden of mouth health and directly link to the needs of restorative dental service. An increased proportion of tooth loss implies a need for implementing preventive education, early treatment, prosthodontic care and greater access to restorative dental services for older people. There has been an increase in prevalence of tooth loss in adults aged 65 years and older, as shown in figure 2, which includes complete tooth loss and loss of six or more teeth.

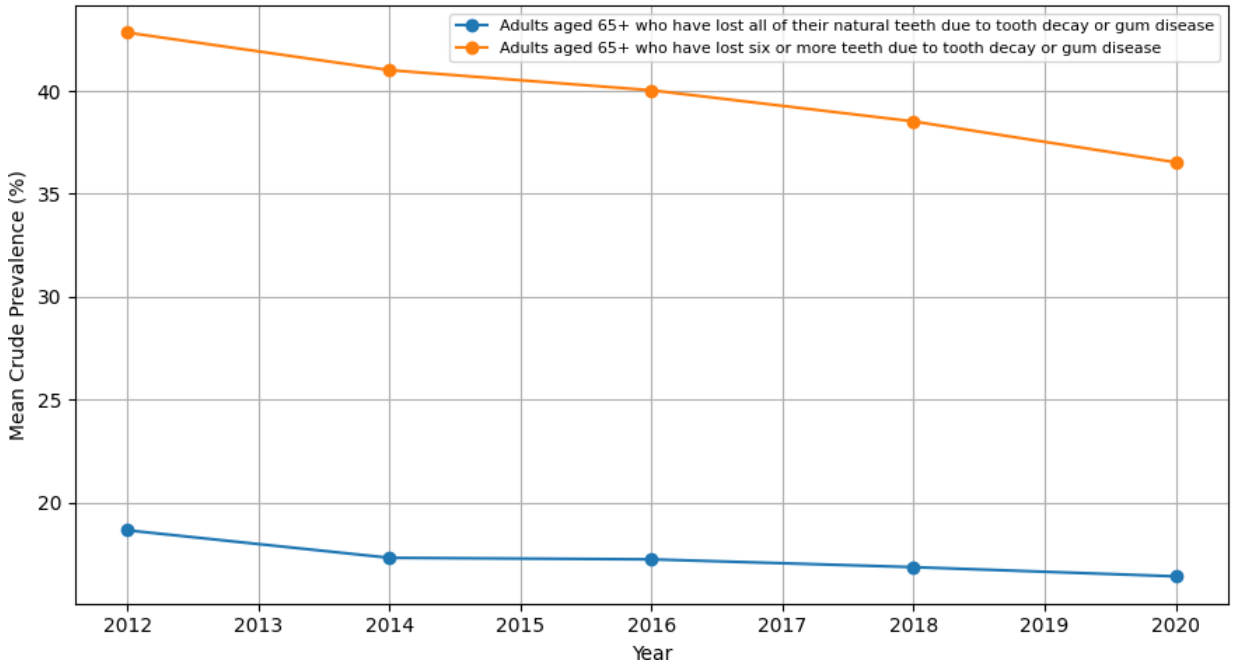

Figure 2. Tooth Loss Trends Among Adults Aged 65+

3.4 Differences by Socioeconomic Factors

There were socioeconomic and demographic differences observed in oral health indicators. Adults had the highest prevalence of dental visits who are college educated at 79.62% and lowest in adults who have less than a high school education at 44.35%. The same income-related pattern was found for the other. The highest prevalence of adults who visited a dentist was found to be 78.37% among adults with an income of $50,000 or more, and the lowest prevalence was among adults with an income of less than $15,000 (44.78%). These results indicated that there existed a strong link between education and income and utilization of dental services. The socioeconomic status

also had a significant impact on tooth loss. Highest rate of complete edentulousness (33.89%) was observed in adults with less than a high school education, and the lowest was seen in those with a college education (4.33%). Additionally, adults who had not completed high school had the highest rate of complete tooth loss (61.06%) and lowest had a college degree (17.97%). The same was true for income differences. Prevalence of complete tooth loss among adults was 31.02% for those with income less than $15,000 and 5.91% for those with income of $50,000 or more, with adults in both groups having prevalence of six or more missing teeth of 60.09% and 21.22%, respectively. There were racial differences, too. Prevalence of dental visits was highest among white adults (68.86%) and lowest among Hispanic adults (58.34%). Among older adults with complete tooth loss, the prevalence was highest for the Black adults at 23.31%, and the multiracial adults at 22.72%. The loss of six or more teeth was also greatest for black adults, 54.48%. Income and education differences were greater than gender differences. The dental visit prevalence for female adults was significantly higher than for males (68.51% vs. 62.75%) and proportion of adults missing 12 or more teeth was approximately equal. Table 3 looks at oral health indicators by socioeconomic and demographic status, such as education, income, race, and gender.

Table 3. Differences in Oral Health Indicators by Socioeconomic and Demographic Factors

Category	Group	Dental Visit (%)	Lost All Teeth (%)	Lost Six or More Teeth (%)
Education	College graduate	79.62	4.33	17.97
Education	Some post H.S.	67.83	11.57	33.43
Education	H.S. or G.E.D.	60.16	18.64	43.67
Education	Less than H.S.	44.35	33.89	61.06
Income	$50,000+	78.37	5.91	21.22
Income	$35,000-$49,999	65.09	11.87	33.75
Income	$25,000-$34,999	57.72	17.40	41.74
Income	$15,000-$24,999	50.24	24.19	51.01
Income	Less than $15,000	44.78	31.02	60.09
Race	White	68.86	14.36	34.07
Race	Black	59.06	23.31	54.48
Race	Hispanic	58.34	16.53	36.76
Race	MultiRacial	58.37	22.72	47.23
Race	Other	61.69	20.51	39.41
Gender	Female	68.51	15.50	36.38
Gender	Male	62.75	14.96	37.46

3.5 Geographic Variation

Geographic variation was evaluated using the mean crude prevalence values between locations. There were 55 locations in the data set so that comparisons could be made between adult dental visits and indicators of tooth loss by states in the U.S., at the national level, and selected territories. Geographic variation is important because it may signal differences in access to dental care, availability of oral health programs, and insurance coverage, community outreach, and public health policy support. Dental visit prevalence rates that are lower in certain locations may need more specific oral health education and better access to preventive and restorative dental services. Higher prevalence of tooth loss may be associated with higher cumulative oral disease burden and/or higher need for restorative dental care planning in the area. Geographic variation in the prevalence of dental visits in the most recent available year is illustrated in Figure 3.

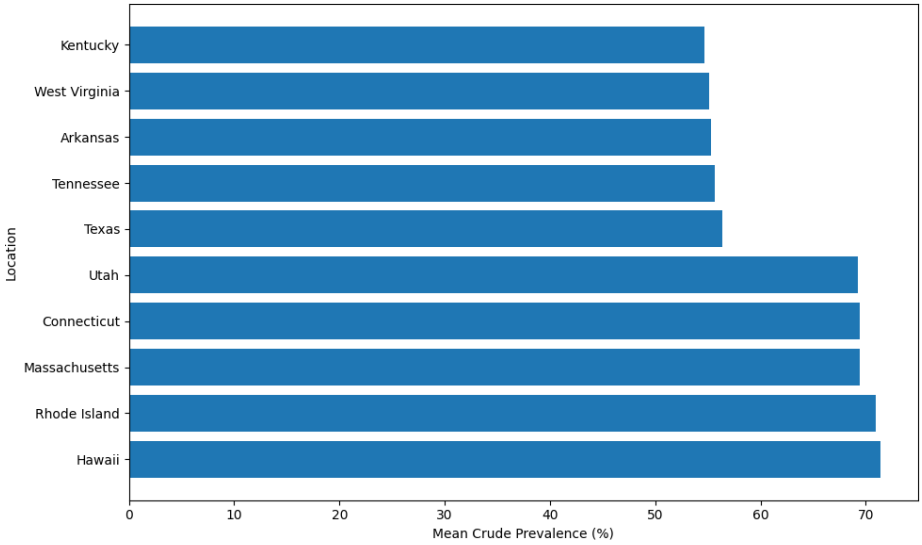

Figure 3. Geographic Variation in Dental Visits

3.6 Summary of Main Findings

The findings revealed that the prevalence of visits to the dentist for adults with dental visits between 2012 and 2020 remained fairly consistent (62.15% to 63.74%). In 2018, the prevalence of dental visits was highest, and also decreased slightly in 2020. Oral disease burden and need for restorative dental services remained significant, despite the loss of teeth among 65 years and older adults.

The education and income variables showed greatest differences. Prevalence of dental visits among adults and the prevalence of tooth loss among adults were higher among higher educated and higher income adults than lower educated and lower income adults. Adults with less than high school education and those with incomes less than $15,000, however, had lower rates of dental visits and much higher prevalence of tooth loss. There were also racial differences, with the highest rates of total absence of teeth and 6 or more missing teeth in older adults. Based on these results, oral health education, behavior change interventions, community outreach, and policy interventions must focus on lower income populations, less educated adults, older adults and populations with the greatest tooth loss burden.

4. Discussion

Findings from this study show that oral health disparities among adults are still a major public health issue despite progress in the provision of preventive and restorative dental care services [14]. The overall rate of dental visit was relatively stable from 2012 to 2020, suggesting that routine dental services provision has not seen significant changes over time. A significant proportion of older adults namely, those without any teeth and the ones without 6+ reveals a long-standing issue of oral disease and the requirement for restorative dental services in older people [15,16]. Another discovery was very high socio-economic differences, including income and education, among people with low income and education being more likely to experience tooth loss, and less likely to visit a dentist. Similar patterns have been seen globally; disadvantaged groups are more likely to have poor oral health outcomes, which are also linked to limited access to oral health services, lower levels of oral health literacy and oral health social inequities [17,18].

Because they improve oral health outcomes and lessen the lifetime cost of restorative dental care, behavioural therapies are significant. Oral health education programmes enhance patient knowledge about oral hygiene, the use of fluoride, the importance of routine dental care visits and diet for oral disease prevention. Motivational interviewing and oral hygiene counselling may help people to change their oral health behaviours and get into the routine of taking care of their mouths. Eating less sugar is especially important because it is known to be directly linked to tooth decay. Furthermore, the effects of smoking on periodontal disease, tooth loss and oral cancer make it important to help smokers quit [19]. Like digital reminders and follow-up communications, dental visit reminders may also help to increase preventive care utilization, especially for those who do not get routine dental care. The link with oral health outcomes indicates the importance of oral health prevention and health promotion, and education can make a big difference in oral health literacy [20]. Community outreach efforts are critical to address oral health disparities and access to preventive and restorative care, in addition to what has already been mentioned. By facilitating access to care for underserved and rural populations who may have financial or locational constraints, mobile dental clinics and free/low-cost dental screening programs can help. Preventive education and healthy behaviors can be promoted at the community level by school-based and workplace oral health programs. Bramantoro et al. showed that school-based oral health promotion programs can positively impact oral health knowledge and oral health preventive behaviors across age groups [21]. CHWs can also be used to link vulnerable populations to the health care system and deliver oral health education and support services. Targeting strategies should be especially focused on older adults and low-income individuals due to their higher level of tooth loss and utilization of fewer preventive dental services in the current study. Also highlighted that oral health promotion can be integrated into their community and systemic healthcare approaches and this will help to enhance their oral and systemic health outcomes [22]. Interventions at the policy level are needed to decrease structural inequalities in access to oral health care. Increasing coverage for adult dental services and enhancing Medicaid benefits for adults will help to increase access to preventive services and decrease the burden of untreated oral disease. Another benefit of OH integration in PHCS is to provide an opportunity to facilitate early detection of oral health issues and early referral to oral health services, particularly for vulnerable groups within the health care system. Fisher et al pointed out the need to build the oral health system within the framework of universal health coverage [23]. Moreover, the Global Strategy and Action Plan on Oral Health 2023-2030 highlights the importance of integrated and preventive approaches to oral health and care delivery systems. Greater investment in preventive and restorative dental care, especially in disadvantaged areas and rural regions will help to close the gaps in oral health care access and improve oral health equity [10]. Prevention-focused public health policies can also help to mitigate the economic costs of the consequences of untreated oral disease, and their restoration [24].

The results of this study have implications in the field of restorative dentistry due to the potential of preventing the progression of oral diseases and the need for more advanced restorative methods in a younger age of disease. The best way to avoid tooth loss and maintain good oral health is by taking proactive steps to prevent it. This study had several strengths, including the size of the surveillance sample, the ability to evaluate trends across multiple years, and the inclusion of subcategories of the demographic and socioeconomic variables to assess disparities within that subcategory for oral health. But there were a number of limitations to this study as well [25]. Moreover, no specific clinical data regarding

the particular type of restoration treatment provided to the individuals was available.

There is a need for intervention in these groups and communities lacking access to oral health care providers and with a high prevalence of missing teeth through the implementation of oral health awareness, outreach and policy efforts based on the evidence uncovered by these findings. Improving preventive oral health care can be very beneficial in preventing additional oral disease and to foster oral health equity.

5. Conclusion

National Oral Health Surveillance was used to look at the oral health trends and disparities in adults. The findings showed that prevalence of dental visits was relatively stable throughout the period of the study and dental loss continued to be a large oral health problem for older people. There was considerable variation among income, education, gender, and racial/ethnic subgroups and age. Dental visits were also not as well utilised and greater numbers of adults who had lower incomes and education had more complete tooth loss and more than two missing teeth, indicating inequalities in access to preventive and restorative dental services. The results point to significance of social, behavioural and policy determinants of oral health. Preventative Oral Health Education and/or behavioral counseling and regular dental exams are crucial to the prevention of oral disease and to the reduction of the need for more advanced restorative treatments. Increasing access to care and oral health awareness for populations through outreach programs such as mobile dental services, school and workplace outreach and outreach to special populations can improve access to oral health care. In addition, there is a need to provide policy interventions to expand dental insurance coverage, improve dental benefits in Medicaid, and integrate oral health into primary care systems to reduce oral health disparities. Overall, study highlights about importance of evidence-based oral health promotion and prevention policies and programs to support optimal oral health and reduce dental loss and plan for optimal restorative care for adults in an equitable manner.

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