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ORAL HEALTH DISPARITIES AMONG UNDERSERVED POPULATIONS IN NIGERIA

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Oral health disparities among underserved populations in Nigeria

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ABSTRACT

The prevalence of oral health problems has remained a global challenge and efforts are being made to address the challenge but there is a lot of disparity in underserved rural areas. The poor and socially disadvantaged people especially those in the underserved areas lack equal opportunity to access adequate oral healthcare services and this is the major cause of the high prevalence of untreated or poorly treated oral health problems in rural communities. This review aimed to highlight the oral health disparities in underserved populations; and for the success of the review, we searched databases such as PubMed, Google Scholar, MEDLINE, Cochrane Library, and Microsoft Academic to obtain up-to-date literature. We restricted the search to articles published within the last decade but due to the scarcity of publications in most developing countries of interest such as Nigeria, we included older publications to enable us to get a comprehensive view of the disparities in these areas. Results showed that poor and rural communities suffer a lot of oral health disparity because there are no dental care facilities available in their communities, they lack orientation about the importance of good oral health, the cost of accessing dental services is high, and there is not enough workforce to meet the overwhelming need for oral healthcare intervention. These imply that these underserved populations are deprived of the opportunity to have a healthy mouth.

Keywords: *Surveillance, oral health disparity, oral healthcare access, underserved population*

INTRODUCTION

Globally, significant advances have been made in the prevention, diagnosis, and treatment of oral diseases. These advancements have also resulted in the improvement of the quality of life of millions of people. Despite these advancements, certain segments of the population still experience an unacceptable and disproportionate burden of oral disease. This preventable difference in the burden of disease, injury, violence, or opportunities to achieve optimal health experienced especially by socially disadvantaged populations is called health disparities (Centres for Disease Control & Prevention [CDC], 2021). According to Gustavo (2014), oral health disparities exist among ethic, socioeconomic, racial, and demographic subgroups across many countries – developed, developing, and underdeveloped countries. These disparities are both unjust and unfair, unnecessary, and avoidable.

Oral diseases, affect not only health but aesthetics and frequently result in tooth loss which can be a deterrent to the improvement of the socioeconomic status of vulnerable populations. There is an awareness among the oral health

practitioners of the endemic disparities in oral health between and within countries, however, that is not the case among the general health professionals and the political communities (Northridge et al., 2020) Oral diseases have been considered a separate entity despite documented evidence of their relationship with systemic diseases and general health. This way of thinking has resulted in policies that are detrimental to the prevention and treatment of oral diseases, especially among vulnerable populations. Most oral diseases are preventable, and many have common risk factors (e.g., Diet high in sugar, tobacco, and alcohol use) with the prevalent non-communicable diseases (NCDs) such as cancer, obesity, heart disease, and diabetes (Ucheka et al., 2021). As documented by Gustavo (2014), disparities in oral health care are due to a myriad of factors including social, structural, personal, socioeconomic, and geographic factors.

Nigerians continue to be afflicted by Oral health conditions such as dental caries and periodontal disease, especially in the disadvantaged and underserved communities. Despite the seeming progress recorded with the introduction of the 2012 oral health policy in Nigeria, access to oral health has remained poor partly because of poor integration of oral health into general health care, ignorance, socioeconomic factors, and demographic patterns (Adeniyi et al., 2012). In a bid to improve access to equitable oral health care, the Nigerian Government included oral health care in the National Health Insurance Scheme (Uguru et al., 2020). Distinct oral health disparities, however, continue to exist in Nigeria among the low-income groups, rural dwellers, uninsured, those residing in medically and dentally underserved areas, and the handicapped. This review, therefore, seeks to investigate all aspects of oral health disparities in Nigeria among the underserved population.

GLOBAL ORAL HEALTH BURDEN

Oral diseases ravage the health and quality of life of the poor and socially disadvantaged members of society globally (Marco & Peres, 2019). The association between socioeconomic status (income, occupation, and educational level) and the prevalence and severity of oral disease, is very strong and consistent, (Marco & Peres, 2019). This association exists from early childhood to older age, and across populations in high, middle, and low-income countries (Marco & Peres, 2019). Most common oral health conditions include dental caries, periodontal disease, oral cancers, oral manifestations of HIV, oro-dental trauma, cleft lip and palate, and noma (severe gangrenous disease starting in the mouth mostly affecting children in the poor/rural areas). Most oral health conditions are largely preventable and can be treated in their early stages.

The Global Burden of Disease [GBD] (2017) study reported that oral diseases affect close to 3.5 billion people worldwide, with caries of permanent teeth being the most common condition. The GBD (2017) study estimation says that 2.3 billion people suffer from caries of permanent teeth and more than 530 million children suffer from caries of primary teeth. In most low- and middle-income countries, with increasing urbanization and changes in living conditions, the prevalence of oral diseases continues to increase due to unequal distribution of oral health professionals and a lack of appropriate health facilities in most countries means that access to primary oral health services is often low. The overall survey of adults expressing a need for oral health services access ranges from 35% in low-income countries to 60% in low- and middle-income countries, 75% in upper-middle-income countries, and 82% in high-income countries. Moreover, even in high-income settings, dental treatment is costly, averaging 5% of total health expenditure and 20% of out-of-pocket health expenditure (Organisation for Economic Cooperation and Development [OECD], 2017).

Among the prevalent oral diseases, dental caries and periodontal disease have been considered the most rising global oral health burdens. Dental caries is still a major health problem in most industrialized countries as it affects 60–90% of school-aged children and most adults as updated in the epidemiological database of the World Health Organization [WHO] (2014). Despite being largely preventable, these diseases are among the most prevalent non-communicable

diseases globally, with significant health, social and economic impacts. People are affected over their life course, from early childhood to adolescence and adulthood (WHO, 2020).

In the face of this global oral health burden, Mary et al. (2020) observed that the rural population globally was disadvantaged and lacked the equal opportunity to access oral healthcare like those in the cities. This disparity is caused by social, structural, personal, socio-economic, and geographic factors. A qualitative study utilizing focus groups conducted with African American, Puerto Rican, and Dominican older adults who attend senior centers in northern Manhattan, New York City, indicated that all four of these levels are indeed salient to oral health care (Northridge et al., 2017). Health systems, as well as oral health educational institutions, focus more on the curative aspect of oral diseases at the individual level. Therefore, there is a need for continuous training of oral health professionals to emphasize innovation in prevention, health promotion, and trans-disciplinary approaches to the delivery of both personal and population-based services. Strong relationships exist between poor oral health and factors such as low education, low literacy, income, and lack of health insurance coverage. (Adams et al., 2017). In addition, poor oral health may be more prevalent in certain racial and ethnic groups and may be related to acculturation and country of origin. Research studies have shown that even when access to care is not a barrier, individuals do not utilize the oral health care system adequately, and most failed to follow well-known dietary and behavioral preventive regimens. (American Dental Association [ADA] (2019). Competent health communication strategies designed to change behaviour, raise awareness among the public, other health professionals, and policymakers, as well as, timely utilization of existing preventive oral health services, have great potential to reduce and perhaps eliminate oral health disparities globally.

ORAL HEALTH BURDEN: THE NIGERIAN STORY

Oral diseases are one of the most frequently occurring noncommunicable diseases globally. It is estimated that over 3.9 billion people are affected by one oral disease or the other (Ofili et al., 2020). These diseases do not only cause pain and agony, but they also limit an individual's function such as the ability to bite, chew, and speak, and aesthetics causing the loss of man-hours. According to Ofili et al. (2020), the prevalence of oral diseases is higher among the poor and disadvantaged groups in both developed and developing countries. In Nigeria, oral diseases are increasingly being considered a serious national public health problem. There is currently a dearth of literature on the national oral health status of Nigeria. Nevertheless, from the few nationwide surveys available (Akpata, 2004), one can gain an insight into the oral health conditions and disease burden in Nigeria. As is the case globally, dental caries and periodontal disease are the commonest oral diseases in Nigeria. Others include oral tumors/cancers, malocclusion, fractures, dental fluorosis, etc. More than 50% of Nigerian adults aged 15 years and above suffer from one oral disease or the other (Akpata, 2004). According to a National Oral Health Survey [NOHS] as reported by Adeniyi et al. (2012), the prevalence of dental caries and periodontal disease in Nigeria stood at 30% and 80% respectively. On the other hand, Olusile et al. (2014) reported that more than 70% of adult Nigerians have periodontal disease and most carious lesions remain untreated. This figure is believed to be a gross underestimation of the oral disease burden in Nigeria because it considered only those presenting to the hospitals or clinics for care. This is so because those in the rural areas rarely have a functional oral healthcare facility, and many Nigerians patronize unorthodox healthcare providers. According to Ofili et al. (2020), the burden of oral diseases in Nigeria shows a pattern of deterioration because of its close link with poverty, low level of awareness, poor socioeconomic condition of the people, and inadequate oral health care facilities.

Despite several improvements in oral health across the globe, dental caries still contributes to the global burden of diseases. In developed countries, though having the highest prevalence rate of dental caries, there has been a decrease in its occurrence, attributable to better oral hygiene

practices and fluoride use. Available evidence shows that dental caries in Nigeria varies from very low in rural areas to moderate in urban areas (Akpata, 2004). Studies have reported a prevalence range of between 4% to 30% in Nigeria (Ofili et al., 2020; Akpata, 2004). This figure is believed to be on the increase among certain segments of the urban population, with the prevalence reported being higher than 40% among some segments of urban dwellers (Adeniyi, 2004; Fraihat et al., 2019). The wide range of differences between the urban and rural dwellers is attributed to socioeconomic differences since those in the urban areas are more likely to afford and consume diets high in cariogenic sugar (Uguru et al., 2020). Akpata (2004) reported the prevalence of dental caries in Southern Nigeria to be about 33% in the urban areas and 3% in the rural areas. For Northern Nigeria, the prevalence stood at 58% and 32% for the urban and rural areas respectively, confirming a high prevalence of dental caries among the urban dwellers. An early study by Adegbombo and El-Nadeef (1995) reported the prevalence among Nigerians aged 12 years or less to be 30% whereas that of children 15 years or more was 45%. In another study by Akpata (2004), only about 3% of children aged 12 – 15 years old in South-South had dental caries as against about 13% of children of similar age in the North-Central Geopolitical Zone of Nigeria. Thus, highlighting the level of disparities in dental caries prevalence between Northern and Southern Nigeria.

The occurrence of periodontal disease is said to be related to oral hygiene and socioeconomic status and Nigeria is not an exception in this regard. The prevalence of periodontal disease in Nigeria according to Akpata (2004) is between 15 – 58%, higher in adolescents and increases with age. In a comparative study on the prevalence of periodontal disease between Northern and Western Nigeria by Enwonwu as reported by Akpata (2004), the prevalence of destructive periodontitis stood at 15% and 40% in Northern and Western Nigeria respectively. He also reported the age-related prevalence of periodontal pockets for ages 10-19years and 20-22year to be 33% and 58% respectively. Adegbombo and El-Nadeef (1995) in their study showed that there was a difference in the periodontal health of rural and urban dwellers. They observed that while the prevalence of periodontal disease among the underprivileged rural children in Western Nigeria is 15-27%, no case was recorded among the children of the high social class in the urban area.

Access to oral health care in Nigeria has remained poor partly because of poor integration of oral health into general health care, ignorance, socioeconomic factors, and demographic patterns (Adeniyi et al., 2012). In a bid to improve access to equitable oral health care, the Nigerian Government included oral health care as part of the National Health Insurance Scheme (Uguru et al., 2020). Distinct oral health disparities, however, continue to exist in Nigeria among the low-income groups, rural dwellers, uninsured, those residing in medically and dentally underserved areas, and the handicapped. Certain factors have been shown to influence access to oral health in Nigeria such as shortage and uneven distribution of the dentist, lack of interdisciplinary collaboration, high cost of dental treatments, lack of dental insurance, fear and anxiety, poor oral health literacy, misconceptions, and perceptions about oral health care among the populace, etc. (Ajayi & Arigbede, 2012, Bersell, 2017). In many developing countries such as Nigeria, there is a shortage and maldistribution of dentists leaving many oral diseases untreated. According to Uguru et al. (2020), the number of registered dentists in Nigeria as of 2012 was about 4125 with a dentist to population ratio of 1:40,000, however, by 2017 the dentist to population ratio had dropped to 1:38,600. An oral health survey in Nigeria conducted in 2011 involving 7,630 participants aged 18-80 years before the introduction of the National Oral Health Policy in 2012 showed that more than 50% of the participants had never been to a dentist (Ajao, 2018). Generally, health resources in Nigeria are scarce, however, in the allocation of these resources little or no attention is given to oral health care by the decision-makers in Nigeria. This is because oral health care is seen by health policymakers in Nigeria as insignificant when

compared to other areas of health care (Adeniyi et al., 2012, Fraihat et al., 2019).

CAUSES OF ORAL HEALTH DISPARITY

Lack of Awareness

According to Rural Health Information Hub [RHIHub] (2021), people in underserved communities are not well informed about oral healthcare services they can access. So, if they feel pain and discomfort due to any oral disease(s), they will not know what to do for themselves or where to go for proper treatment.

Poverty

El-Yousfi et al. (2019) and Nolika et al., (2020) explained that poverty is a major reason why the underserved population lacks the required oral healthcare they need. El-Yousfi et al. (2019) and Nkolika et al. (2020) further posited that the cost of dental services is high for people with low socioeconomic status.

Poor Attitude

Ajayi and Arigbede (2012) stated how some of the underserved populations show some ignorant attitudes to receiving oral healthcare services brought to them. Uguru et al. (2020) also stated that oral healthcare in certain countries like Nigeria receives very little or no proper attention because the government and health policymakers still see the sector as insignificant.

Location of Oral Care Service

Uguru et al. (2020) stated that the geographic location of dental care facilities is a major discouraging factor to accessing oral healthcare by the underserved population. This implies that it is difficult for rural communities to access the needed oral care services because the few dental professionals available are working in facilities far from their reach.

Lack of Funding and Cost of Treatment

As stated by Uguru et al. (2020) and Adeniyi et al. (2012), if there is not enough funding, dental facilities would not be procured. Even the existing facilities still experience a lack of inadequate supply of equipment and materials needed for optimum operation. Again, Uguru et al. (2020) explained that the level of poverty people in underserved locations experience is one of the reasons why they cannot afford the cost of oral healthcare services.

Lack of Planning and Implementation of Oral Health Policies

Hannan et al. (2021), Uguru et al. (2020), and Adeniyi et al. (2012) stated that governments of some countries and healthcare regulatory authorities show little or no concern about policies on oral healthcare that will improve the oral healthcare sector and reduce the disparities in the underserved populations. If leaders at all levels are not responsible for their roles in the implementation of WHO policy on the incorporation of oral health into primary healthcare services, it widens the neglect and disparity in the underserved areas. The US Department of Health and Human Services, Office of Disease Prevention and Health Promotion's Healthy People 2030 is a pacesetter and an example of strategic action plan countries should create to salvage the oral health disparity situation.

Shortage of Professionals

Uguru et al. (2020) showed that the ratio of dentists to population ratio in Africa is 1:150,000. This is very discouraging compared to developed countries where the ratio is 1:2000 dentists. Despite the seeming encouraging dental health professionals-population ratio in developed nations, RHIHub (2021) stated that rural areas in America, for example, still have workforce shortages.

THE EFFECTS OF ORAL HEALTH DISPARITY

The general and oral health-related quality of life due to oral health disparity is adversely affected (WHO, 2021). Northridge et al. (2020) explained how neglected maternal oral health problem affects the oral health of infants and children. Northridge et al. (2020) further linked untreated oral diseases in pregnant mothers to adverse pregnancy outcomes and compromise of the health of the child's teeth. Correa-Faria (2018), Riggs et al. (2020), Gupta et al. (2020), and WHO (2021) emphasized that the prevalence and adverse effects of dental caries and periodontal disease are globally increasing, leading to damage and loss of teeth. Similarly, necrotizing gingivitis and periodontitis if not treated may

lead to Cancrum Oris (NOMA), which has been reported to cause up to 90% fatality rate in affected children in underserved poor populations. (WHO, 2021 & Yactayo-Alburquerque et al., 2021).

MITIGATING ORAL HEALTH DISPARITY

Oral Health Promotion

RHIHub (2021) stated that in underserved communities, oral health literacy is poor and that makes them vulnerable to oral diseases throughout the life course. According to Northridge et al. (2018), poor socioeconomic status, and geographic location are major contributory factors to the low level of oral health literacy in rural areas. It is very important to adopt oral health promotion programs patterned towards addressing unhealthy lifestyles, lack of preventive primary and oral healthcare, poor nutrition, excessive alcohol intake, and tobacco use that affect the teeth and their supporting structures, leading to dental caries, oropharyngeal cancers, periodontal disease, and eventually tooth decay and tooth loss (Collares et al., 2018 and Northridge et al., 2018). Therefore, oral health promotion is an excellent measure to deal with disparities and their effects (RHIHub, 2021).

General and Oral Health Intervention by Adoption of Preventive Approach

As stated by the WHO in the decision of the WHA of 2020, oral healthcare professionals must shift from curative to preventive approaches and strategies to mitigate the disparities by encouraging basic home self-care measures and seeking professional care when made available to them. Again, the CDC (2021) and RHIHub (2021) stated that certain interventions are important for the oral health of a population such as promoting the use of affordable and effective fluoride in its various forms and improving access to primary oral health care to help preserve tooth structures and maintain healthy teeth (Northridge, 2020; Hannan et al., 2021). Another intervention is through general and oral health promotion against unhealthy lifestyles like intake of foods high in refined sugars which also causes dental caries, (Northridge, 2018; RHIHub, 2021). Thus, limiting sweets as part of a healthy diet through interventions at all levels will promote better oral health and may also reduce the incidence of obesity, diabetes, and related health conditions, (Uguru et al., 2021; Northridge, 2020).

Oral and general health conditions may be improved by regular dental visits, deploying of oral health care professionals to rural areas, provision of free oral hygiene materials, education, and promotion of good oral health care to the grassroots (Luo et al., 2018). This will help in early and periodic screening, diagnostic and treatment services for low-income infants, children, adolescents, and the aged. These can lead to positive improvements in dental coverage for children, even as socioeconomic and racial/ethnic disparities in dental visits and oral health indicators remain (Kranz and Dick, 2019).

Government Healthcare Policies and Recruitment of Oral Healthcare Professionals

The contribution of the government to ensure that oral health disparities especially in rural communities are curbed cannot be overemphasized (WHO, 2021). Adeniyi et al. (2012) enumerated some of the roles the government should take to achieve equal access to oral healthcare. The study supported that the government's policies on oral health should also focus on the implementation of the World Health Assembly recommendations to the WHO which among others included the incorporation of dental services into the Primary Healthcare services. Leaders of governments should make the health reforms effective by procuring dental equipment and materials and recruiting oral health professionals for the primary healthcare centers to provide efficient oral care. Employing more dental professionals will increase the workforce-to-population ratio and serve to reduce the disparities (Adeniyi et al., 2012).

Again, the WHO (2021) suggested that schools should be health-promoting by engaging health officials who can use their professional knowledge to ensure good health for the school personnel, pupils/students, families, and the community. The government and private investors alike should be encouraged to take dental training institutions to the rural areas to create oral orientation and promote interest in the

oral health professional courses among the candidates in the rural communities who will assist to address the oral health needs of their communities after graduation (Brickle & Self, 2012; Nash et al., 2012; Lynch, 2020).

The Role of the Professional Regulatory Bodies

Adeniyi et al. (2012) posited that adequate training of dental students is very important and should be monitored by the professional regulatory bodies and health ministries to ensure that competent hands are graduated and deployed to practice their full-fledged roles enshrined in the gazette that defined their respective scopes of practice.

Proper Referral System and Professional Synergy

Pompeia et al. (2017), WHO, (2020), and Becker and Mendez (2020) highlighted the importance of basic knowledge of oral healthcare assessment by every healthcare provider to enable them to identify some oral health problems (especially ankyloglossia, cleft lips, and palate in children) and refer the patient for appropriate dental care.

CONCLUSION

This review showed that universal and targeted interventions at every level and location are needed to eliminate disparities in access to oral health care in Nigeria. Oral health professionals when distributed evenly will care for more racially/ethnically diverse old and younger patients who demand oral health care services. So, there is the need to leverage the commitment of public health, medical, and dental leaders, and practitioners to integrate and refocus training, redesign and expand coverage and increase access to oral healthcare services for all that need it because, no one deserves pain and suffering consequent on their age, socioeconomic status, and location.

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REFERENCES

Adams, S. H., Gregorich, S. E., Rising, S. S., Hutchison, M., & Chung, L. H., (2017). Integrating a nurse-midwife-led oral health intervention into centering pregnancy prenatal care: Results of a pilot study. *Journal of Midwifery Women's Health, 62*(4), 463–69.

Adegbombo, A. O., & El-Nadeef, M. A. (1995). National study of periodontal status and treatment need among Nigerians. *International Dental Journal, 45:*197-203.

Adeniyi, A. A., Sofola, O. O., & Kalliecharan, R. V. (2012). An appraisal of the oral health care system in Nigeria. *International Dental Journal, 62*(6), 292–300. https://doi.org/10.1111/j.1875-595X.2012.00122.x

Ajayi, D., & Arigbede, A. (2012). Barriers to oral health care utilization in Ibadan, South-West Nigeria. *African Journal of Health Sciences, 12*(4), 507-513

Ajoa, H. (2018). Oral health workforce planning in Nigeria. *Journal of Otolaryngology, Head and Neck Surgery,* 4,18. https://doi.org/10.24966/OHNS-010x/100018

Akpata, E. S. (2004). Oral health in Nigeria. *International Dental Journal, 54(*6 Suppl 1), 361-6

American Dental Association. (2019). Health policy inst. dental practice. *Fact Sheet*, ADA. https://www.ada.org/en/science-research/health-policy-institute/data-center/dental-practice

Becker, S., & Mendez, M. D. (2020). Ankyloglossia. *StatPearls.* https://www.ncbi.nlm.nih.gov/books/NBK482295/#!po=90.0000.

Bersell, C. H. (2017). Access to oral health care: A National crisis and call for reform. *Journal of Dental Hygiene, 91*(1), 6-14

Brickle, C. M., & Self, K. D. (2017). Dental therapists as new oral health practitioners: Increasing access for underserved populations. *Journal of Dental Education*. *81*(9), eS65-eS72. https://doi.org/10.21815/JDE.017.036.

Centers for Disease Control and Prevention. (2021). Community Health and Program Services (CHAPS): Health disparities among racial/ethnic populations. U.S. Department of Health and Human Services.

Collares, K., Opdam, N. J., Peres, K.G., Peres, M. A., & Horta, B.L. (2018). Higher experience of caries and lower-income trajectory influence the quality of restorations: A multilevel analysis in a birth cohort. *Journal of Dentistry 68*, 79–84.

Correa-Faria, P., Daher, A., Freire, M. C., Abreu, M. H., Bonecker, M., & Costa, L. R. (2018). Impact of untreated dental caries severity on the quality of life of preschool children and their families: A cross-sectional study. *Quality Life Research. 27*(12), 3191-3198. https://doi.org/10.1007/s11136-018-1966-5.

El-Yousfi, S., Jones, K., White, S., & Marshman, Z. (2019). A rapid review of barriers to oral healthcare for vulnerable people. *British Dental Journal, 227*, 143 - 151. https://doi.org/10.1038/s41415-019-0529-7

Fraihat, N., Madae'en, S., Bencze, Z., Herczeg, A., & Varga, O. (2019). Clinical effectiveness and cost-effectiveness of oral-health promotion in dental caries prevention among children: systematic review and meta-analysis. *International Journal of Environmental and Public Health Research, 16*(15), 2668.

Global Burden of Disease. (2017). Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018 Nov *10;392(*10159), 1789-1858. https://doi.org/10.1016/S0140-6736(18)32279-7.

Gupta, A., Nishant., Sharda, S., Kumar, A., Goyal, A., & Gauba, K. (2020). Comparing the effectiveness of topical fluoride and Povidone Iodine with topical fluoride alone for the prevention of dental caries among children: A Systematic Review and Meta-analysis. *Internal Journal of Clinical Pediatric Dentistry*. *13*(5), 559 - 565. https://doi.org/10.5005/jp-journals-10005-1844.

Gustavo, D. C. (2014). Oral health disparities: Opportunities and challenges for policy communication. *Journal of Communication in Healthcare*, 7:2, 74-76. https://doi.org/10.1179/1753807614Y.0000000049

Hannan, C. J., Ricks, T. L., Espinoza, L., & Weintraub, J. A. (2021). Addressing oral health inequalities, access to care, knowledge, and behaviors. *Preventive Chronic Disease. 18*, 210060. https://doi.org/10.5888/pcd18.210060.

Kranz, A. M., & Dick, A. W. (2019). Changes in pediatric dental coverage and visits following the implementation of the

Affordable Care Act. *Health Services. Research. 54*(2), 437–45.

Langelier, M., Moore, J., Baker, B. K., & Mertz, E. (2015) Case studies of 8 federally qualified health centers: Strategies to integrate oral health with primary care. http://www.oralhealthworkforce.org/wp-content/uploads/2015/11/FQHC-Case-Studies-2015

Luo, H., Bell, R. A., Wright, W., Wu, Q., & Wu, B., (2018). Trends in annual dental visits among US dentate adults with and without self-reported diabetes and prediabetes, 2004–2014. Journal of American Dental Association.149(6):460–69

Lynch, A. (2021). Update on dental therapy in the United States. *Dimensions of Dental Hygiene*. https://dimensionsofdentalhygiene.com/update-dental-therapy-united-states/

Marco, A., & Peres, A.l. (2019) Oral diseases: A global public health challenge. *Lancet*. https://doi.org/10.1016/S0140-6736(19)31146-8.

Mary, E., Northridge., Anjali Kumar., & Raghbir Kaur (2020). *Disparities in Access to Oral Health Care.* https://dx.doi.org/10.1146%2Fannurev-publhealth-040119-094318.

Mehrtash, H., Duncan, K., & Parascandola, M. (2017). Defining a global research and policy agenda for betel quid and areca nut. *Lancet Oncology*, *18*(12), e767-e775

Mertz, E. A. (2016). The dental-medical divide. *Health Aff. 35*(12), 2168–75.

Northridge, M. E., Chakraborty, B., Salehabadi, S.M., Metcalf, S. S., & Kunzel, C., (2018) Does Medicaid coverage (modify the relationship between glycemic status and teeth present in older adults? *Journal of Health Care Poor Underserved* 29(4):1509–28.

Northridge M. E, Shedlin M, Schrimshaw E. W, Estrada I, & De La Cruz L, (2017). Recruitment of racial/ethnic minority older adults through community sites for focus group discussions. *BMC Public Health 17*(1), 563.

Northridge, M. E. (2018) Oral health equity for minority populations in the United States In Oxford Bibliographies in Public Health. Oxford, UK: Oxford University Press. http://www.oxfordbibliographiesonline.com/view/document/obo-9780199756797/obo- 9780199756797-0172.

Northridge, M. E., Kumar, A., & Kaur, R. (2020). The disparity in access to oral health. *Annual Review Public Health. 41*, 513 - 535. https://doi.org/10.1146/annurev-publhealth-040119-094318

Ofili, D.C., Esu, E.B., & Ejemot-Nwadiaro, R.I. (2020). Oral hygiene practices and utilization of oral healthcare services among in-school adolescents in Calabar, Cross River State, Nigeria. *Pan African Medical Journal*. *36*, 300. DOI: 10.11604/pamj.2020.36.300.25102

Olusile, A.O., Adeniyi, A.A. & Orebanjo, O. (2014). Self-rated oral health status, oral health service utilization, oral hygiene practices among adult Nigerians. BMC Oral Health, 14: 140.

Organisation for Economic Cooperation and Development. (2017). *Health at a Glance 2017: OECD Indicators*, OECD Publishing. https://doi.org/10.1787/health_glance-2017-en. Published 2017. Accessed 13 April 2022.

Paskett, E., Thompson, B., Ammerman, A. S., Ortega, A. N., Marsteller, J., & Richardson, D. (2016). Multilevel interventions to address health disparities show promise in improving population health. Health Aff. 35(8):1429–34.

Pompeia, L. E., Ilinsky, R. S., Ortolani, C. L., & Junior, K. F. (2017). Ankyloglossia and its influence on growth and development of the stomatognathic system. *Rev Paul Pediatrics*. 35(2):216-221. https://doi.org/10.1590/1984-0462/;2017;35;2;00016.

Riggs E., Kilpatrick, N., Slack-Smith, L., Chadwick, B., Yelland, J., Muthu, M. S., & Gomersall, J. C. (2020). Interventions with pregnant women, new mothers, and other primary caregivers for preventing early childhood caries (Review). *Cochrane Database of Systematic Reviews.* 2019(11). https://doi.org/10.1002/14651858.CD012155.pub2.

Rural Health Information Hub, (2021). *Oral health in rural communities.* https://ruralhealthinfo.org/topics/oral-health

Ucheka, P. I., Cinar, A. B., Ling, J., & Derek, R. (2021). A systematic review of the use of common behavioral interventions in oral health and diabetes management. *Orapuh Journal, 2*(3), e819. https://dx.doi.org/10.4314/orapj.v2i3.1

Uguru, N., Onwujekwe, O., Ogu, U.U., & Uguru, C. (2020). Access to Oral health care: A focus on dental caries treatment provision in Enugu Nigeria. *BMC Oral Health, 20*, 145. https://doi.org/10.1186/s12903-020-01135-1.

US Department of Health and Human Services. (2022). *Healthy People 2030*. Office of Disease Prevention and Health Promotion.

World Health Assembly. (2021). World health assembly resolution paves the way for better oral health care. Seventy-fourth world health assembly provisional agenda items 13.1, 13.2, 13.5, and 18. *World Health Organization*. https://www.who.int/news/item/27-05-2021-world-health-assembly-resolution-paves-the-way-for-better-oral-health-care.

World Health Organisation. (2020). *Oral health*. https://who.int/news-room/fact-sheets/detail/oral-health

World Health Organization (2020). *Global database on oral health*. https://www.who.int/news-room/fact-sheets/detail/oral-health.

Yactayo-Alburquerque, M. T., Alen-Mendez, M. L., Azañedo, D., Comande, D., & Hernandez-Vasquez A. (2021). Impact of oral diseases on oral health-related quality of life: A systematic review of studies conducted in Latin America and the Caribbean. *PLOS ONE*, *16*(6), e0252578. https://doi.org/10.1371/journal.pone.0252578.