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Community Health Nursing in Ghana: Dental Hygiene

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Abstract

Dental hygiene is an important contributor to our overall health. Poor dental hygiene practices can lead to plaque buildup, cavities formation, tooth decay, and infection. Infection that began as a result of poor oral hygiene can spread to other parts of the body and cause more serious conditions to develop. Dental health is not a priority among Ghanaian residents and there is a need for updated, evidence based research about this topic. This literature review focuses on community health nursing in Ghana, Africa regarding dental hygiene of the pediatric population in this country. The primary focus is to compare the differences in the oral health and hygiene of this population based on urban versus rural residence. An additional focus is the need for preventive measures and education implementation of oral hygiene practices. In November of 2020, the database MEDLINE Complete (Ebsco), was searched in order to find primary, peer reviewed articles for this literature review. After implementing exclusion criteria and undergoing an abstract review of remaining articles, I was left with 24 articles to be included in this review that underwent a full text evaluation. My focus was then narrowed on comparing four articles that were chosen based on their relevance to the primary purpose of this study. All four articles provided findings on contributions to oral health due to urban versus rural status, with a population focus of children ranging from ages 4-18. It was found that the fluoride ion concentration levels were higher in urban than rural areas of Ghana, which is a risk factor for the development of dental fluorosis in children. The urban pediatric population was more likely to consume sugary foods and drinks, which contributed to the development of plaque and dental carie rates. Plaque accumulation, calculus deposits, gingival inflammation and severity, and the prevalence of gingival disease were all seen to increase with increasing age. Dental caries prevalence was found to be low among all populations, but followed the trend of increasing with

increasing age. There is a need for preventative education regarding oral hygiene practices, such as proper teeth brushing and dietary habits, to prevent the development of infections and prevent an increase in dental caries rates among the Ghanaian pediatric population. Updated research needs to be conducted with a focus on positive versus negative outcomes of oral health following implementation of various preventive measures among the urban versus rural populations in Ghana, Africa.

Introduction

When considering the topic of overall health, oral hygiene has a bigger impact than some may realize. “Oral health cannot be divorced from general health because many oral conditions are intimately related to systemic diseases...” (Aikins, E. A., Eigbobo, J. O., 2014). Without proper oral hygiene, bacteria can reach levels that may lead to oral infections like tooth decay and gum disease. These infections can spread to other parts of the body and lead to heart disease, pregnancy and birth complications, and pneumonia, to name a few. “Oral diseases are a global concern and affect some over 3.5 billion people across the globe” (Awudu, 2020). Even with this high global burden, we have not seen much recent improvement.

One of the first independent tasks that the pediatric population has the ability to perform is oral care, which may be taught at a young age by parents or primary caregivers. This education may be reinforced by healthcare professionals, such as dentists, although “other health workers should not miss opportunities to contribute to oral health promotion” (Aikins, E. A., Eigbobo, J. O., 2014). The question to be asked is, are these children being taught proper methods and do they understand the importance of good oral hygiene? It has been found that “the majority of children have poor oral hygiene, with an estimate of 55-95% with plaque” (Addo, et al., 2002). A

prime example of ways that the pediatric population can be negatively or positively impacted regarding this topic can be found among children residing in Ghana, Africa.

In Ghana, there is little energy directed toward prevention of dental disease because of limited personnel in this area and “visiting a dental hygienist or dentist for preventive treatment is rare” (Hardy, D., Nielsen, C., 1990). Other treatment is also a “very low priority among Ghanaians; moreover, dentistry in Ghana is mostly curative, government oriented and hospital based” (Addo, et al., 2002). The low priority among Ghanaian residents may possibly be attributed to more severe conditions and causes of death experienced by this country such as, “malnutrition, diarrhoeal diseases, measles, acute respiratory infections, and malaria” (Chikte, et al., 1999). In relation to the pediatric population, “the incidence of early childhood caries with sequelae of premature loss of teeth and subsequent development of malocclusion can be associated with inadequate oral hygiene as well as low levels of oral health knowledge...” (Aikins, E. A., Eigbobo, J. O., 2014). Education needs to be aimed at the younger population as a means of health promotion and disease prevention so that good oral hygiene habits are practiced early on and remain a priority throughout life.

It is also relevant to discuss differences in rural vs urban areas of Ghana and how this affects one's oral hygiene. Social class reflects norms, attitudes, behaviors, values, and educational levels, which contributes to personal responsibility for health. Research has shown that, “Ghanaian people from the urban area have a high prevalence of periodontal disease and dental caries. Ghanaian people from the country or ‘bush’ have a high prevalence of periodontal disease and low prevalence of dental caries” (Addo, et al., 2011). In regards to medical professionals, “The distribution of dental surgeons in the country has always been skewed towards the south. Currently, out of the nearly 400 dental surgeons in the country, there are only

8 in the north” (Awudu, 2020). This expanded literature review will aim its focus on the comparison of urban vs rural dental status among the pediatric population in Ghana.

Methods

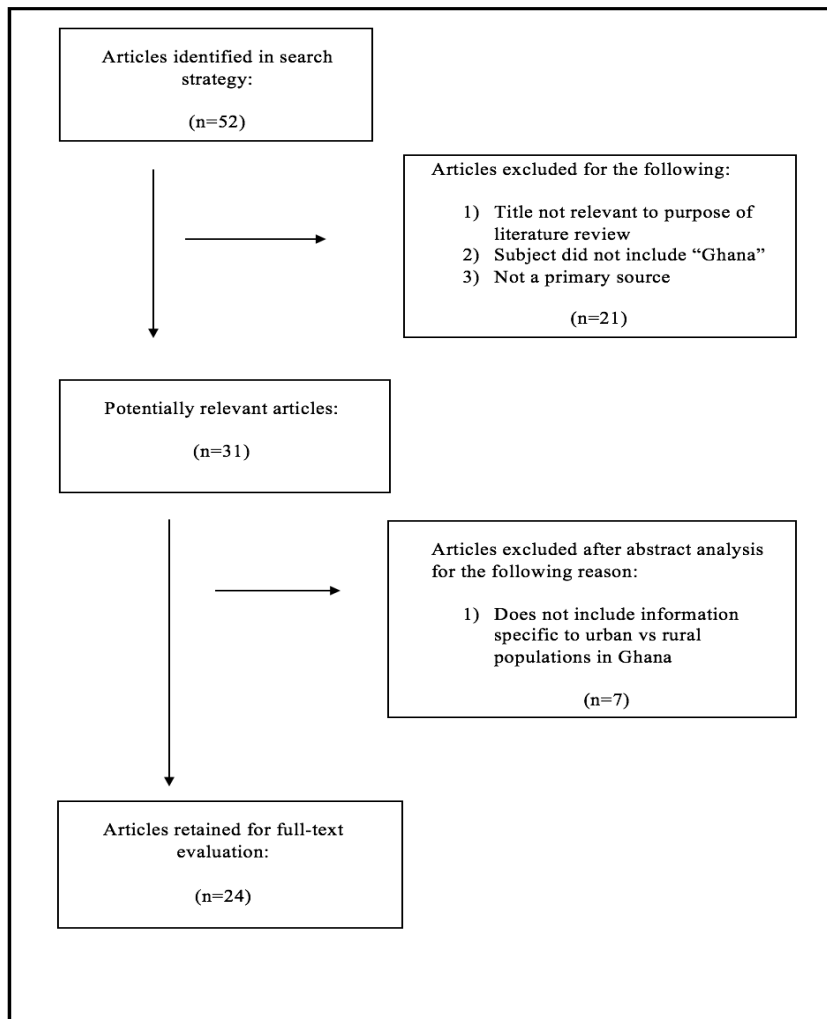
In November of 2020, the database MEDLINE Complete (Ebsco), was searched to systematically choose sources for this review. The search strategy consisted of the keyword searches of “dental care” or “oral care” or “dental hygiene” or “oral hygiene” or “dental health” or “oral health” and “Ghana”. Using the “OR” feature, I was able to find sources throughout this database that included any of the previous phrases mentioned. The “AND” feature ensured that the location of Ghana was mentioned in the article. To be included, the study must have met the following criteria: (a) peer reviewed; and (b) in the English language. “Full article” available was not a factor due to the already limited articles on the topic, but I was able to request full articles via interlibrary loan. After this search was conducted, there were a total of 52 articles. Studies were excluded if: (a) the title was irrelevant to the purpose of this literature review; (b) it did not include “Ghana” in its subject; and (c) it was not a primary source. After implementing the exclusion criteria to the 52 articles identified, 21 were excluded based on irrelevance to this literature review concerning the content of their titles and geographic location, and not being a primary source. The 31 articles that remained underwent an abstract review and 7 were excluded based on having no relation to this literature review’s purpose of urban vs rural populations. I was left with 24 articles to be included in this review that underwent a full text evaluation.

I have narrowed my focus for this literature review on a comparison of four peer reviewed, primary articles found using the criteria listed in this methods section. These articles were chosen based on their relevance to the purpose of this review to determine urban vs rural

dental status in the pediatric population in Ghana, Africa. Each of these articles mentioned key contributions to oral health due to the place of residence, either urban or rural, with a population focus of children ranging from ages 4-18. Each article was concluded by offering a preventive approach to be taken, which is an additional focus of this extensive literature review that will be discussed regarding the implications for nursing practice.

Search method flow chart illustrating data extraction.

(Figure 1).



Results

Soluble Fluoride Levels in Drinking Water- A Major Risk Factor of Dental Fluorosis Among Children in Bongo Community of Ghana, aimed to determine the relationship between the “incidence of dental fluorosis among children and the fluoride levels of the sources of drinking water...” (Awunyo-Vitor, et al., 2013). The study was conducted over a four month period from November, 2008 to February, 2009. To collect data for this study, the Bongo District was divided into four zones based on the major communities in Bongo. Samples of drinking water were taken from these four communities, two of which represented the “Bongo township” and the other two representing the “surrounding villages outside the Bongo township” (Awunyo-Vitor, et al., 2013). In this study, the Bongo township is representative of the urban population, while the surrounding villages are representative of a more rural population. To support the population focus of this study, 200 children between the ages of 7-18 were randomly selected with each zone including 50 children. Children were included if they had spent the first 7 years of childhood in the Bongo area and had used water from a “constant source which could still be traced” (Awunyo-Vitor, et al., 2013). Children with a dental problem different from fluorosis, or a previous use of tobacco or kola, were excluded from the study. These children were all asked the same questionnaire at their homes in their local dialect. The questionnaire included questions regarding the childrens’ “age, level of education, source of drinking water during the first seven years of childhood, location of residence, history of kola, tobacco, or cigarette use, and type of dental care product use” (Awunyo-Vitor, et al., 2013). To determine children who had dental fluorosis, this study used the “Dean’s specific index” recommended by the World Health Organization (Awunyo-Vitor, et al., 2013). The condition of the children’s teeth were broken down into six categories with their own unique characteristics which included: “normal”, “questionable”, “very mild”, “mild”, “moderate”, and “severe” (Awunyo-Vitor, et al.,

2013). The category each child was placed in was based on the most severe form of fluorosis found on at least two teeth, which was determined by a professional examiner. The same process was utilized for each water sample taken from the four different zones to determine the soluble fluoride ion concentration of these different water sources. Findings were considered statistically significant if they received a p-value < 0.05 . Differences were analyzed using the Chi-square test. The demographics of the study population were 54.5% males and 45.5% females with the mean age being 14.5 +/- 2.5 years. It is relevant to note that all children included in the study had a “similar age group, educational background, source of drinking water, oral health care and oral health products,” which was found by each of these categories receiving a p-value > 0.05 (Awunyo-Vitor, et al., 2013). However, cases of dental fluorosis and fluoride ion levels of the different zones of the Bongo District received a statistically significant status with a p-value < 0.05 . When comparing the fluoride levels with the percentage of dental fluorosis present, the p-value was 0.001, according to Table 2 in the study, which proves a significant relationship between the presence of dental fluorosis and the fluoride ion concentration. The two zones taken from the Main Bongo township showed “63% cases of dental fluorosis,” and a fluoride ion concentration that was above the WHO recommendation of 1.5 ppm (Awunyo-Vitor, et al., 2013). The two zones taken from the nearby villages showed “less than 10% recorded cases...” with accepted values according to the WHO recommendation (Awunyo-Vitor, et al., 2013). It was discussed that there are different fluoride ion distribution levels in the soil depending on the region you reside in within Ghana. The article proposed other reasons as to why fluorosis may be present in these children, such as the type of toothpaste products used, the use of kola and tobacco, and variances with age, education, oral health care, and oral health product. However, all of these factors mentioned were disputed by the reasoning that the use of kola and tobacco

was an exclusion factor for this study, and the factors of age group, educational background, oral health care, and oral health product were not found to be statistically significant. The one factor that was statistically significant was “in the cases of dental fluorosis and fluoride ion levels among the villages, p -value < 0.05 ” (Awunyo-Vitor, et al., 2013). As mentioned above, the fluoride ion concentrations in the Bongo township zones were above the WHO recommendation. This study suggests that because of this, the children in this township may have been exposed to fluoride overloads, which lead to fluoride toxicity or dental fluorosis. The exposure to these fluoride levels is mentionable because “in children who are still undergoing mineralization in the permanent teeth, dental fluorosis results in the mottling of teeth due to the impairment in the development of the calcium-phosphate networks” (Awunyo-Vitor, et al., 2013). It was concluded that there is a need of reduction of fluoride ions in drinking water in these communities, such as the Bongo Township, who experience levels above the WHO recommendation. The high levels serve as a major risk factor for the development of dental fluorosis.

Oral Hygiene and Sugar Consumption Among Urban and Rural Adolescents in Ghana

focused on the impact that socio-economic and socio-regional factors have on the distribution of oral health related behaviors, with the end goal of identifying preventative measures to be taken. The assumption is made that “oral health behavior is influenced by personal characteristics and the wider community environment” (Astrøm, et al., 2000). With this in mind, the two main focuses of this study are: (1) “to examine whether socio-regional status (urban/rural) is related to the oral health behavioral patterns of Ghanaian adolescents considering their gender and socio-economic status” and (2) “to examine the extent to which socio-regional status modifies the relationship between individual socio-economic characteristics (parents’ education, gender) and oral health behavior” (Astrøm, et al., 2000). The sample population was students between

the ages of 14-18 attending secondary school in the Awu-tu-Effutu-Senya district in Ghana. This age range was chosen due to the literacy level needed to complete the questionnaire. It was mentioned that schools with large populations in the district tend to attract students of a higher socioeconomic status. All five of the secondary schools in the district were arranged according to their population size into 2 groups. Schools were then randomly selected from the two groups. There were 504 questionnaires considered for statistical analysis. The demographics of the study included a mean age of 16.6 years, 47.4% female, and 52.6% male. 51.6% of the female respondents were raised in urban areas and 57.9% of the male respondents were from rural areas. The questionnaire was voluntary and was administered in the students' school by trained researchers. It included questions regarding health related topics and some specific to oral health behaviors. The study focused on sugar consumption, which was measured by the students' self reported intake of sugary snacks and soft drinks on a scale of 0-5. The education of the students' parents was then taken into consideration and measured as the highest level of education completed using a scale of 0-5. Each parent was given a code of 0 or 1 depending on gender and if the place of residence was rural or urban. It was found that the daily intake of sugary drinks and foods were "consistently and significantly higher among urban than rural residents" (Astrøm, et al., 2000). It was also found among both urban and rural populations, females were more likely to consume sugary drinks and foods than males. When considering students in the rural areas, it was found to be statistically significant that those with parents having a higher education were more likely to consume soda and sweets daily when compared to students with less educated parents. A similar finding resulted among urban residents, with the students of more highly educated parents consuming sugary foods more often. Overall, the daily intake of sugary drinks and foods were most common "among females, those having parents with higher

education, and subjects raised in urban areas” (Astrøm, et al., 2000). This finding was supported by the statistic that students living in urban areas had a larger population of more highly educated parents than rural areas. There is an economic factor that contributes, being that “sugar consumption is most common among the affluent adolescents who can afford such products” (Astrøm, et al., 2000). Therefore, it is understandable as to why students in the urban area, with a greater prevalence of highly educated parents and a higher socioeconomic status, consume sugary foods and drinks more than those living in rural areas. It was found that females and students with more highly educated parents were more receptive to the encouragement of beneficial oral hygiene practices. This is a relevant finding, being that these populations are the “most important target groups for health communication programs aimed at limiting sugar consumption...” (Astrøm, et al., 2000). When considering the results of this study, it is important to aim preventative measures at these target groups because they are most receptive of the education, and were found to be the most in need due to their significantly higher intake of sugary foods and drinks.

Oral Health Status of Peri-urban Schoolchildren in Accra, Ghana focused on the prevalence of dental disease among Ghanaian children. To conduct this study, three primary schools were chosen with a population representative of middle-income, peri-urban communities. These primary schools included students from ages 4-16 and were located in the “Mamprobi area in the Ablekuma District of the Greater Accra Region” (Addo, et al., 2002). Total participants included 1,851, 4-16 year olds. The students’ mouths were examined visually by a lecturer and final year dental students at the University of Ghana Dental School, and were completed according to the WHO Basic Methods. The highest plaque score according to the “Loe and Silness Plaque Gingival indices” was recorded for the student, and calculus was

measured as present or absent (Addo, et al., 2002). It was found that the age group of 4-5 year olds had the least amount of plaque and older age groups had intermediate plaque levels. Males had more severe “plaque accretions” than female students (Addo, et al., 2002). Plaque accumulation and calculus deposits were found to increase with increasing age. Gingival inflammation and severity was also found to increase with age. The prevalence of gingival disease was “slight to very low” among the younger population and “increased significantly from 12 years onward” (Addo, et al., 2002). The final evaluation on the students’ teeth was the presence of dental caries. Dental caries refers to tooth decay that is caused by the breakdown of enamel. The caries prevalence was low, but follows the previously mentioned trends of increasing prevalence with age. The caries free population totaled 77.6% when evaluating the students ages 4-16. There was no significant difference found between the male and female sex regarding caries presence. This study narrowed its focus on caries and periodontal disease among Accra students, due to the financial constraints that would not allow for the evaluation of periodontitis. Two explanations were provided as to why the dental caries rate was low among these children. One contribution could be the use of “chewing sticks and sponges to clean the teeth” (Addo, et al., 2002). The residents make use of local traditional plants that contain antimicrobials and “active plaque inhibiting ingredients” to make these supplies (Addo, et al., 2002). Another explanation is the continuation of a traditional diet “especially in the rural areas...” (Addo, et al., 2002). This diet consists of local Ghanaian dishes that are typically non-cariogenic. The study suggests that the reason for the high prevalence of gingival disease is due to inadequate or ineffective mouth cleansing. It was suggested that this could be improved with the increased and proper use of traditional chewing sticks and sponges that contain antimicrobial agents. It is also necessary to note the need for outreach programmes mentioned in

this study within rural communities of Ghana, to identify high risk communities and implement preventative measures. The study concludes that oral care and health is of low priority to the Ghanaians and that dental care is “mostly curative...” (Addo, et al., 2002). Therefore, there needs to be a greater emphasis on preventive programs to ensure that the low caries rate does not increase and that the rising levels of plaque accumulation and gingival inflammation does not rise to dangerous and unmanageable levels.

Dental Caries Experience in Ghana Among 12-Year-Old Urban and Rural

Schoolchildren was conducted to determine the prevalence of dental caries in urban and rural schoolchildren. By evaluating this, the study aimed to relate the findings to “social class, the reported dietary habits, and dental attendance” (Addo-Yobo, et al., 1991). The sample population was taken from two regions of Ghana: Greater Accra and Ashanti. The urban population was represented by the sample taken from Accra and Kumasi, while the rural population was taken from villages within a 50 mile radius of these 2 cities. The study included a narrow focus of 12-year-old schoolchildren who went to primary and junior secondary schools. There were two categories including “children attending urban schools, either private (fee-paying) schools or government/state (non-fee paying schools)” and “children attending rural (government) schools” (Addo-Yobo, et al., 1991). The schools were selected based on a two-stage random-sampling procedure and each child was then interviewed. The parents’ or guardians’ occupation was noted using the “Social Stratification System of Ghana” (Addo-Yobo, et al., 1991). A questionnaire was administered with topics related to dental attendance and dietary habits, followed by a visual examination of the students’ mouths. To diagnose the presence of dental caries, the World Health Organization criteria was used. Water samples were also collected from each area to determine fluoride levels in the drinking water. Results showed that the fluoride ion

concentration was “less than 0.2 ppm of fluoride” and only one location sampled in the “rural area in the Greater Accra region” had a fluoride ion concentration of 0.23 ppm (Addo-Yobo, et al., 1991). When considering the urban vs rural populations, it is necessary to note the student population at each school sampled. Based on the social stratification system mentioned above, the most privileged children (considered to be in social class I and II) attended urban schools, with the private schools in Accra having the highest proportion of these social classes. The rural schools contained more students from social class IV and children from the intermediate background were found to be in equal attendance in urban and rural schools. In regards to dietary habits, students in urban schools were found to consume three meals a day plus snacks, such as “a sandwich, pie, cakes, or biscuits in addition to a sweetened drink” (Addo-Yobo, et al., 1991). Students from rural schools tended to not consume snacks and ate food sold around the school, such as “rice, plantain, and other traditional foods” (Addo-Yobo, et al., 1991). Results from the questionnaire found that 90% of students reported never having been to the dentist. Findings from the oral examination resulted in 78.5% of the study population being caries free. 68.3% were from urban communities and 88.3% were from rural communities. It was not statistically significant when determining the presence of caries between boys and girls. However, “there was a highly significant difference in DMFT values between urban and rural areas” (Addo-Yobo, et al., 1991). Even though the caries prevalence was low in regards to the total population studied, trends showed that schoolchildren from Ashanti rural or urban government schools were lower than the urban, private schools in Accra. The study suggests that the higher incidence of dental caries in the urban population is due to differences in dietary habits. The higher income, urban population tends to shift their eating habits from the more traditional Ghanaian meals to “refined carbohydrates” and “between-meal snacks” (Addo-Yobo, et al., 1991). In the more rural areas of

Ghana, such as the Ashanti region, people depend more on traditional foods like “yam, plantain, and cassava” compared to the Accra region where the population consumes foods such as “bread and corn products as well as sugarcane...” (Addo-Yobo, et al., 1991). The study suggests that fluoride ion concentration levels were unlikely to have influenced dental caries among these schoolchildren since all samples taken were below the recommended concentration. Although the caries prevalence among the focus population of this study were found to be relatively low, there is uncertainty about the effects these caries and poor dental hygiene practices may have when they reach adulthood. The result that 90% of these schoolchildren had never been to the dentist needs to be addressed. If these dentist visits cannot be attended whether it be due to lack of motivation or personnel, low priority, financial constraints, etc., there needs to be a greater focus on preventive measures. These measures should be implemented in the younger population to prevent the increase of dental carie rates that could pose long term negative effects on the dental health of this population.

Characteristics of reviewed articles.

(Table 1).

Study; Year of Publication	Mean Age; Age Range (years); sample size	Region/District of Focus in Ghana	Oral Health Problem Investigated; Tool/Criteria used for Diagnosis	Main Findings
<i>Soluble Fluoride Levels in Drinking Water- A Major Risk Factor of Dental Fluorosis Among Children in Bongo</i>	Mean age- 14.5 +/- 2.5 years Age range- 7-18 Sample size- 200	Bongo District divided into Bongo Township and surrounding villages outside the Bongo township	Prevalence of dental fluorosis in children based on fluoride ion concentration levels in sources of drinking water; Dean’s specific index (recommended	A significant relationship was found between the presence of dental fluorosis and the fluoride ion concentration; Main Bongo township (urban) showed 63% cases of dental fluorosis and fluoride

<i>Community of Ghana; 2013</i>			by World Health Organization) used to diagnose dental fluorosis; WHO recommendation of 1.5 ppm was used for comparison of fluoride ion concentration	ion concentration above the WHO recommendation; nearby villages (rural) showed less than 10% recorded cases with accepted values according to the WHO recommendation
<i>Oral Hygiene and Sugar Consumption Among Urban and Rural Adolescents in Ghana; 2000</i>	Mean age- 16.6 Age range- 14-18 Sample size- 504	Awu-tu-Effutu-S enya District	Common oral hygiene practices and sugar consumption from foods/drinks depending on urban vs rural residence	daily intake of sugary drinks and foods were most common among females, those having parents with higher education, and subjects raised in urban areas
<i>Oral Health Status of Peri-urban Schoolchildren in Accra, Ghana; 2002</i>	Mean age- N/A Age range- 4-16 Sample size- 1,851	Mamprobi area in the Ablekuma District of the Greater Accra Region	Presence of plaque accumulation and calculus deposits, gingival inflammation and disease, and dental caries; oral examination conducted according to WHO Basic Methods; plaque scores recorded according to Loe and Silness Plaque Gingival indices	Plaque accumulation, calculus deposits, gingival inflammation and severity, and the prevalence of gingival disease were all seen to increase with increasing age; dental caries prevalence was low among all populations, but followed the trend of increasing with increasing age
<i>Dental Caries Experience in Ghana Among</i>	Mean age- N/A Age range- 12 Sample size-	Greater Accra and Ashanti Regions	Prevalence of dental caries in relation to social	Low prevalence of dental caries; dental caries trends lower in

<i>12-Year-Old Urban and Rural Schoolchildren; 1991</i>	985		class, dietary habits, and dental attendance of urban vs rural populations; dental caries recorded using the World Health Organization criteria	children from rural or urban government schools of Ashanti, trends higher among urban, private schools in Accra; higher income, urban population more likely to consume sugary drinks/foods than their rural counterparts; fluoride ion concentration levels unlikely to have influenced dental caries among children since all samples taken were below the recommended concentration
<i>Africa: A Dentist's Charitable Experience of a Lifetime: 2004</i>	N/A	Buduburam Refugee camp (country in central West Africa)	Oral surgical care provided by a dentist to adults residing in this refugee camp; performed tooth extractions	Many of the residents had never had professional dental care and proved to have little knowledge about oral hygiene. The dental clinic had no electricity, running water, or plumbing system. Water used to clean instruments was polluted. The most severe residents were seen to perform tooth extractions.
<i>Chewing Sticks Versus Toothbrushes in West Africa: 1989</i>	Mean age: 30 years old Age range: 20-40 years old Sample size: 163	Accra, Ghana and Kumasi, North Ghana	Plaque measured using the Plaque Index of Silness and Loe; bleeding assessed as present or absent; mean	Found that chewing sticks had no advantage to oral hygiene and gingival health over toothbrushing; plaque scores were higher in those who used

			plaque and gingivitis scores in relation to tooth-cleaning method	chewing sticks instead of a toothbrush; little difference found in oral hygiene of urban vs rural residents
<i>Child and Maternal Oral Healthcare; An Assessment of the Knowledge of Nigerian and Ghanaian Nurses; 2014</i>	Mean age: 37.8 +/- 9.6 years Age range: 21-65 year old Ghanaian nurses and midwives Sample size: 160	Health institutions in Cape Coast, Ghana and Port Harcourt Nigeria	data was collected through questionnaires about knowledge of oral healthcare in pregnant women and children, opinions on tooth cleaning material, frequency of tooth cleaning, importance of routine dental visits, care of baby/children teeth, association between mother and child oral health conditions, and knowledge of infant/child oral health	Found that nurses and midwives in Ghana demonstrated better knowledge than those in Nigeria regarding child oral healthcare; knowledge of child oral healthcare was insufficient; Ghanaian nurses had better knowledge of preventative care than those in Nigeria
<i>Common risk factors and edentulism in adults, aged 50 years and over, in China, Ghana, India and South Africa: results from the WHO Study on global</i>	Mean age: n/a Age range: 50+; almost half the study was between ages 50-59 with 5% 80+ years Sample size: 25,179	China, India, Ghana, and South Africa	WHO-SAGE longitudinal study; data collected through face to face interviews using individual questionnaires with questions regarding prevalence of	Prevalence of edentulism was 2.9% in Ghana; rural residents were more likely to be edentulous in China, but less likely to be edentulous in Ghana; edentulism was associated with angina in Ghana residents

<i>AGEing and adult health (SAGE); 2016</i>			edentulism; age and sex standardizations were based on WHO's World Standard Population	
<i>Dental Survey in the Brong Ahafo Region of Ghana; 1967</i>	Mean age: n/a Age range: children attending primary schools (grades 1-6); 4-18 years old Sample size: 715	Brong Ahafo Region of Ghana	Oral examinations performed by one dentist with recording procedures of the Canadian Dental Association; examining for dental caries prevalence, tooth loss, oral hygiene and gingivitis	Children in Ghana were found to have 1/3 of the caries prevalence and tooth loss as Canadians; found to have much worse oral hygiene and more gingivitis than Canadians; suggested that higher gingivitis rates in Ghana can be associated with oral hygiene in the country
<i>Edentulism and quality of life among older Ghanaian adults; 2015</i>	Mean age: 64.2 +/- 10.73 years Age range: 50+ Sample size: 4,724	Ghana	Self reported edentulism; quality of life measured using the 8 item WHOQOL measure; assessed the relationship between edentulism and quality of life among older adults living in Ghana	Edentulism was found to be associated with lower levels of SWB, satisfaction with life, morale and self esteem; contributed to impaired communication; there was no association between edentulism and happiness; females and respondents with no formal education reported lower quality of life
<i>Hygiene critical in the Third World; 1990</i>	Mean age: n/a Age range: 5-16 Sample size: n/a	Accra, Ghana	Dental hygienist assessed clinical and educational dental hygiene needs of	Urban areas have high prevalence of periodontal disease and dental caries while rural areas have high

			Ghanaian people; dental hygienist performed oral screenings/examinations	prevalence of periodontal disease and low prevalence of dental caries; found to be a need for oral health education
<i>Irrelevant oral health; 2006</i>	N/A	Ghana	Contributor to prosthodontics programme at University of Ghana Dental School discusses his annual visit to Ghana	Oral health was found to be irrelevant to those suffering from other, more severe conditions; programme at University of Ghana focused on training dental personnel to work with other local health care workers; teaching includes dental reconstructive techniques
<i>Meeting the oral health needs of Ghana; 2020</i>	N/A	Ghana	Need for sufficient human resources for health based on global strategy for human resources for healthy by WHO in 2016; discussed overall topic of oral health in Ghana	Stated that oral healthcare workforce is disproportionately distributed and majority are located in urban areas of Ghana; There is a mix of dental professionals in Ghana with dental surgeons skewed towards the south
<i>Multidimensional Health Locus of Control Scales: Applicability Among Ghanaian Adolescents; 2002</i>	Mean age: 16.6 Age range: 14-18 years old Sample size: 504	Awutu-Effutu-Senya district of Ghana	The students completed questionnaires that were administered by trained researchers; the questionnaire used the IHLC and CHLC	50% urban and 48% of rural respondents reported health as an important issue; Over 90% were correctly informed about oral health, tooth cleaning, tobacco/smoking and sugar consumption

			scales; data was collected on oral hygiene behavior, sugary snacks and drinks, and oral health knowledge	
<i>Options for Types of Dental Health Personnel to Train for Ghana; 2006</i>	N/A	Ghana	A semi-structured interview was given to get background information about the training and development of oral health personnel in Ghana; Interviewees included the Chief Dental Officer of the Republic of Ghana, Dean of the University of Ghana Dental School, President of the GDA, and the vice president of the GMA	There was disagreement about aspects of planning personnel requirements; there was found to be a lack of detail regarding registration and regulation of all categories of oral health personnel in Ghana
<i>Oral Health Among Liberian Refugees in Ghana; 1999</i>	Mean age: 25.7 +/- 9.5 years Age range: 11-62 Sample size: 196	Gomoa Buduburam refugee camp (west of Accra, Ghana)	A social worker from the Liberian HELP-Society was trained by a dentist on the diagnosis of dental caries, periodontal disease, and malocclusion; 4	There was a low prevalence of dental caries and a high prevalence of malocclusion; a high % of patients had bleeding; oral health was found to have a low priority in health

			Liberian nurses and doctors helped the social worker with the survey; the WHO methods and guidelines were used	care planning for refugees
<i>Oral hygiene practices, oral cleanliness and periodontal treatment needs in 12-year old urban and rural school children in Ghana; 1991</i>	Mean age: n/a Age range: 12 year olds Sample size: 985	Ashanti and Greater Accra regions of Ghana; urban sample from Kumasi and Accra; rural sample villages within a 50 mile radius of the two urban cities	Children were interviewed about methods of oral hygiene and parents information was grouped based on the social stratification system of Ghana; Clinical exams were performed by the principle investigator to look for debris or substantial deposits	38% of children used a toothbrush, 31% used chewing sticks, 17% used plantain and 14% used a chewing sponge; traditional methods were preferred in rural areas; Oral debris was present in 84% of the sample with more than $\frac{3}{4}$ having calculus deposits; children from urban areas had the cleanest mouths and the lowest periodontal treatment need
<i>The Orthodontic Management of an Adult with Sickle Cell Disease; 2015</i>	Mean age: n/a Age range: 25 year old female with sickle cell disease Sample size: 1	University of Ghana Dental School	An extra-oral and intra-oral assessment were completed by an orthodontist to determine symmetry, appearance, oral hygiene, teeth position, and treatment plan	There is no established protocol for orthodontic treatment of patients with sickle cell disease; oral infections are considered a high risk factor of a sickle cell crisis
<i>Type II diabetes and oral health: perceptions among adults with diabetes and oral/health</i>	Mean age: n/a Age range: 20-45 years old for the younger focus groups and 45+ for the older	Accra, Ghana (University of Ghana Dental School, the UG School of Public	Interviews were conducted by a lead moderator and co-leader followed by informant	Half of the participants with diabetes had oral manifestations; participants were generally unaware of the relationship

<i>care providers in Ghana; 2013</i>	focus groups Sample size: 59	Health, and the Diabetes Centre)	interviews completed by the principal investigator; questions were asked regarding diabetes control, opinions on oral health, and the connection between their diabetes diagnosis and oral health	between diabetes and oral health; dental treatment was found to be minimal; oral health was not found to be incorporated into diabetes screening/treatment
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Discussion/Conclusion

After evaluating the four articles chosen, similar findings were discussed regarding the differences that living in an urban vs rural residence have on the oral health and hygiene of the pediatric population living in Ghana. While the results of these studies contributed to the purpose of this literature review, there is still further research needing to be conducted surrounding the topic of education and implementation of preventative measures within this population.

There was a common finding regarding the eating habits among children in rural and urban areas. They all found that the daily intake of sugary meals, drinks, and snacks was higher among children residing in urban areas than their counterparts living in rural areas. This was also true of children whose parents held a higher education and income than their peers. Parents with this demographic were more likely to live in the urban communities of Ghana. This supports the reasoning that these children could afford to consume the more expensive sugary products than children living in rural areas, who were more likely to partake in a traditional, more affordable

diet. Frequent consumption of sugary foods and drinks without proper teeth cleaning leads to the development of plaque; a mixture of bacteria, mucus, and other particles that can lead to tooth decay, dental caries (cavities) and gum disease. Cavities and tooth decay can lead to severe toothache, infection, and tooth loss. In more severe cases, periodontitis, or gum disease, can result. This is a “serious gum infection that damages the soft tissue and can destroy the bone that supports your teeth” (Mayo Clinic, 2020). This can cause tooth loss as well as the entrance of bacteria into the bloodstream through the gum tissue. Bacteria can then travel to other parts of your body and cause the development of a diagnosis such as “respiratory disease, rheumatoid arthritis, coronary artery disease, and problems controlling blood sugar in diabetes” (Mayo Clinic, 2020). The typical prevention measure suggested for plaque growth is brushing your teeth with fluoride toothpaste twice a day, for two minutes each time, and limiting foods with added sugars. This relates to another finding of this literature review.

The significant relationship between the presence of dental fluorosis and the fluoride ion concentration of an area was discussed. The result of the fluoride ion distribution level varied depending on the region of Ghana being researched. The fluoride levels of drinking water in urban communities were found to be higher than in rural areas. *Dental Caries Experience in Ghana Among 12-Year-Old Urban and Rural Schoolchildren* had similar results of the more urban area studied having an increased fluoride ion level. Drinking water containing high levels of fluoride ions was found to be a major risk factor for the development of dental fluorosis. Fluorosis can lead to discoloration and mottling of developing teeth in children, but does not cause harm to the teeth otherwise. With this in mind, the high fluoride levels of the drinking water in Ghana may prove to be more beneficial than harmful to its residents. These high levels, found mostly in northern areas of Ghana, contribute to the low cavity (carie) rate among children

in these regions. Even though the dental carie rate proved to increase with increasing age and be higher in children from urban areas, the overall dental caries prevalence was found to be low among this pediatric population. As mentioned above, a measure taken to prevent the development of plaque and cavities is brushing your teeth with fluoride toothpaste. In areas of Ghana, instead of using toothpaste containing fluoride, the fluoride in the drinking water treats the presence of plaque in these children. The same areas found to have a higher carie rate and likelihood of sugary food and drink consumption (urban) were the same areas found to have higher fluoride ion concentration levels in the drinking water. It's important to note that people living in Ghana often can't afford to drink bottled water, let alone brush their teeth daily with bottled water. This leads to children using the highly fluoridated drinking water to brush their teeth on a daily basis. Therefore, they are helping prevent the development of plaque that comes from consuming these sugary foods, just by using their own drinking water to brush their teeth.

The final similarity found in all articles was the need for preventative measures being taken towards the dental hygiene of this pediatric population. The articles called for preventive oral health and education programmes for adolescents in Ghana. These programmes can be utilized to “prevent Ghana going the way of other countries which started with low caries rates and reportedly are now experiencing increasing rates,” and “to control and contain periodontal health from deteriorating to unmanageable levels” (Addo, et al., 2002). While I agree with the statements made regarding the need for efforts aimed at prevention measures and education, there were minimal suggestions offered by these articles on how to accomplish this. Research needs to be conducted on realistic, best practices for oral hygiene and dental care in this population. It was claimed that there is a need to “drastically reduce the fluoride ions in drinking water,” but does not provide a solution to do so (Awunyo-Vitor, et al., 2013). A solution to this

could be to focus education on treating the well water of Ghana with clorox through a process called shock chlorination. This allows for home water systems, such as wells, to be disinfected. The clorox helps treat bacterial contamination in these water systems, making it safe to drink. This also serves as a solution to residents in Ghana being unable to afford bottled water. Using the well water as a new source of drinking water, instead of the highly fluoridated water, would decrease the risk of fluorosis development in Ghanaian children. Suggestions were also made to increase the proper and effective use of traditional chewing sticks and sponges. As discussed earlier in this literature review, chewing sticks and sponges are made using traditional plants that contain antimicrobials that inhibit plaque growth. However, there have been some discrepancies found with this statement. Despite their antimicrobial components, chewing sticks “offer no advantage to oral hygiene and gingival health over tooth brushing” and “overall plaque scores were significantly higher in the individuals who used wood sticks...” (Addy, M., et al., 1989). Another study found that “a traditional chewing stick still used extensively in Ethiopia, was reported to be as effective as the toothbrush in removing oral deposits among children” (Addo-Yobo, et al., 1991). There is further research needed about this topic to confirm or deny the effectiveness of traditional oral hygiene methods. If these methods are proven to be beneficial, this seems like a feasible solution due to financial constraints and poverty experienced by Ghanaian residents. Due to these constraints, “toothbrushes are still a luxury in many rural communities” and “fluoridated toothpastes cannot be used” (Addo-Yobo, et al., 1991). However, chew sticks also wear down the enamel on teeth, especially at the gum line. Enamel, the protective surface of the teeth, is an important line of defense. The destruction of enamel could lead to the development of cavities and infection, like periodontitis. The human body does not create more enamel, so it’s important to protect this layer and prevent the alteration of its

integrity. To accomplish this, education needs to be aimed at ways to inhibit plaque growth, protect enamel, and prevent the development of infections, such as periodontitis.

Good oral hygiene practices need to be made a priority and become part of the daily routine for the Ghanaian pediatric population in both urban and rural areas. This means brushing teeth twice a day for at least 2 minutes each time. This prevents “an environment around your teeth that is favorable for specific bacteria that cause periodontal disease” (Mayo Clinic, 2020). Research has shown that “toothbrush users did brush with greater frequency, and a higher proportion of them had cleaner mouths” (Addo-Yobo, et al., 1991). Even if children are brushing their teeth twice a day for 2 minutes, if they are not doing so in the proper way, the effectiveness of this prevention measure will be diminished. Children, especially from lower social classes, “are less likely to clean their teeth effectively on a daily basis because of the lack of parental awareness and supervision of personal oral hygiene” (Addo-Yobo, et al., 1991). Therefore, the correct way to brush teeth needs to be taught to this pediatric population as well as parents or caregivers. This way, the adult figure can reinforce the proper way to brush teeth if the child is doing so incorrectly. Education should include the topic of the process and supplies needed for toothbrushing. The toothbrush head should be small and bristles should be soft enough to get between the teeth and gums to remove bacteria growth that could be forming where food may have collected. The toothbrush should be placed at a 45 degree angle to the teeth, and the teeth should be gently brushed in a circular motion. Each part of the tooth should be brushed (outside, inside, and chewing surfaces) followed by the gentle brushing of the tongue to remove bacteria. These steps should be repeated twice a day for 2 minutes, morning and night. In areas where sugary foods and drinks are more likely to be consumed, such as urban areas of Ghana, it is important to teach about consuming these in moderation. Children should be taught about foods

and drinks that fight against decay, such as fiber rich fruits and vegetables, and dairy products to help produce saliva and provide a good source of calcium. I would also recommend the increased consumption of the local drinking water. Since the drinking water in Ghana contains higher levels of fluoride, increasing its intake will help strengthen the teeth and prevent bacteria growth. This is an especially feasible solution for children in urban areas who are more likely to consume sugary foods and drinks, and for children in rural areas who may not be able to afford fluoridated toothpaste or a soft bristled toothbrush. If children are unable to use a toothbrush and result in using traditional chewing sticks and sponges, the proper use of these products needs to be taught to decrease the destruction of enamel.

It's important that children in Ghana receive this education since oral hygiene may not be a priority or seem of importance to this population. However, dental hygiene can have greater negative effects than some may realize. As previously mentioned, poor oral care can lead to infection, which can enter the bloodstream through gum tissues. Nurses have a responsibility in preventing the development of these more threatening diagnoses. It's important for nurses to assess the oral hygiene practices of children by asking simple questions such as, "How many times do you brush your teeth a day?" or "How long do you brush your teeth each time?" They can also ask the child to demonstrate how they brush their teeth, provide feedback, and ask the child for another demonstration. This way, the nurse can assess if the teaching was effective. While it's not within a nurses scope of practice to diagnose a dental condition, such as dental caries, periodontitis, or plaque formation, they do have the ability to assess the oral mucosa. They can assess if the oral mucosa is moist and pink, the cleanliness of the oral cavity, and if the gum line may seem irritated, by being observed as red or inflamed. By implementing this into normal practice, nurses can help prevent poor oral hygiene and the development of serious

conditions that poor dental care can lead to. Prevention is key among Ghanaian children. As mentioned, the dental carie rates are relatively low and efforts need to be made to keep them from increasing. The task of brushing your teeth twice a day for two minutes, slightly altering diet to consume less sugary foods and drinks, and increasing the local fluoridated drinking water, should be taught to the children in urban and rural areas of Ghana. A way to accomplish this would be to have nurses, dentists, or students in nursing/dental school in Ghana, visit schools in different regions of Ghana and provide a short presentation on the prevention measures previously mentioned. They could then educate on how to effectively brush teeth. To ensure that this teaching is understood, the children could provide a demonstration following the presentation.

Study limitations were found may have led to different results when reviewing these articles. One limitation was which criteria was used to diagnose dental caries in Ghanaian children. While the studies *Oral Health Status of Peri-urban Schoolchildren in Accra, Ghana* and *Dental Caries Experience in Ghana Among 12-Year-Old Urban and Rural Schoolchildren* utilized the WHO Basic Methods criteria, the two articles were published with an 11 year difference. The World Health Organization may have changed their criteria between the times, making the criteria used to diagnose dental caries different for the two studies. Another limitation found was which personnel conducted the oral examination. For example, the examination in *Oral Health Status of Peri-urban Schoolchildren in Accra, Ghana* was conducted by a lecturer and final year dental students at the University of Ghana. In *Dental Caries Experience in Ghana Among 12-Year-Old Urban and Rural Schoolchildren*, the study was conducted by a principal investigator. Whoever is completing the exam could have different opinions, which is supported by the statement that “students tended to over-diagnose and inflate the caries rates...” (Addo, et

al., 2002). It's important to note that the questionnaires administered to the students were all written differently and the age of the children answering the questionnaires were different among all 4 studies. This could alter the results of the questionnaire based on the child's developmental level, educational level, or due to the fact that "the observed levels of self reported behavior might have been biased due to the respondents' tendency to present a favorable image of him or herself" (Astrøm, et al., 2000). A gap in the literature was found in *Oral Health Status of Peri-urban Schoolchildren in Accra, Ghana* with financial constraints that would not allow for the evaluation of periodontitis. Another gap is that there is a need for updated information regarding current, dental hygiene practices among the pediatric population in Ghana, within the last 5 years, as some of these more frequently used practices may have changed. The development of periodontitis was underexplored in these studies, and research should be conducted regarding this diagnosis, due to its severity. The effects that dental hygiene practices of these Ghanain children may have in their future adult years was also not mentioned in any of the articles reviewed.

In conclusion, dental hygiene needs to become a priority when considering one's overall health. Poor oral hygiene can lead to the development of more serious conditions that may reach unmanageable levels. There is a need for updated, evidence based research about oral hygiene practices and successful preventive measures that can be implemented in the pediatric population of Ghana. While there were differences found in the reviewed articles regarding fluoride levels, dietary habits, and the presence of certain dental problems, based on the area of residence in Ghana, prevention and education needs to be aimed at both the urban and rural populations.

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